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SCHNEIDER (F.). **Vergleichende biologische Prüfung von Winterspritzmitteln.** [Comparative biological Tests of Winter Sprays.]—*Schweiz. Z. Obst- u. Weinb.* **54** no. 25 pp. 437–443, 3 figs., 1 ref. Wädenswil, 1945.

Comparative tests were made in the winter of 1944–45 of the value against eggs of *Aphis pomi*, Deg., and *Operophtera brumata*, L., of 26 preparations used as winter sprays on fruit trees in Switzerland. They comprised oil emulsions, tar distillates of the types known as normal and emulsified carbolineums [*cf.* *R.A.E.*, A **35** 70], preparations of dinitro-cresol [containing an alkaline salt of dinitro-o-cresol (*cf.* *loc. cit.*)], and one of dinitro-o-cresol in a tar distillate. The technique employed is described in detail. Twigs or shoots bearing eggs of the insects were dipped into the liquids for about 10 seconds and subsequently attached in an upright position to laths on a stand erected in the open, where they were left for the rest of the winter. The treated shoots were examined one or two weeks after the eggs of *A. pomi* and *O. brumata* had hatched on untreated shoots, which occurred about 25th March and 3rd April, respectively. The results are shown in detail and discussed. With the exception of one American product, which was satisfactory against *O. brumata*, none of the oil emulsions was effective against either insect. Most of the tar distillates gave very high mortalities of one or other of them, but only one gave complete mortality of both. Some of the dinitro sprays killed all the eggs of both species, and their effectiveness against *O. brumata* was greater in late February and March than earlier. Special analysis of dinitro sprays showed that those of pH 7·3–7·8 were more effective against *O. brumata* than those of pH 9·7–10 [*cf.* **33** 15]. The combined spray gave complete mortality of *O. brumata*, but not of the Aphid.

SCHNEIDER (F.). **Die San José-Schildlaus im Südtirol.** [The San José Scale in South Tyrol.]—*Schweiz. Z. Obst- u. Weinb.* **55** no. 3 pp. 50–56, 4 figs. Wädenswil, 1946.

The danger of the spread to Switzerland of *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., from Austria, France or Italy [*cf.* *R.A.E.*, A **33** 125], where it is now an established pest of fruit trees, is thought to have been greatly increased by war-time relaxation of control measures in those countries. The author reviews the precautions taken to prevent its introduction from South Tyrol, and describes investigations on the extent of infestation there, made during a recent visit. Imports of apples from South Tyrol were increased in 1945, and it was found in November of that year that the routine fumigation with methyl bromide that has long been carried out on the frontier was inadequate owing to the low temperature. A federal decree was issued in December temporarily forbidding the import of all fresh pip fruits from countries where the Coccid was known to occur, hand-sorting of the large accumulations of fruit on the frontier was instituted, and only uninfested fruits were released for sale.

The Coccid is stated to have been introduced into South Tyrol 8–10 years previously on nursery stock from the district of Verona, which has served as an important source of infestation for several years [*cf.* **31** 180]. Infestation was most serious in a region to the south of Bolzano and was less severe in damp, low-lying valleys than on dry, sunny mountain slopes. The control measures taken included 2–3 post-blossom applications of a spray of lime-sulphur containing 0·05 per cent. nicotine as nicotine sulphate, in addition to the routine winter treatment with lime-sulphur. It was observed that fruits in the most seriously affected area were still slightly infested even after one treatment in winter and three in summer. Apple trees in particularly dry positions, and pear trees infested with more than one species of scale, were sprayed with a tar distillate. In the district of Ora, where control measures had been abandoned owing to war conditions, infestation had increased to such an extent that many trees were encrusted with scales, the typical red discoloration had spread to the cambial zone, and one tall tree, which had given a normal yield of fruit only two years previously, was moribund. Examination of the encrusted surface indicated that the older scales had mostly dried up, and that the half-grown insects overwintered in large numbers.

SCHNEIDER-ORELLI (O.). **Weitere *Dreyfusia*-Untersuchungen.** [Further Investigations on *Chermes*.]—*Mitt. schweiz. Anst. forstl. Versuchsw.* **24** pt. 1 pp. 103–132, 13 figs., 30 refs. Zürich, 1945. (With a Summary in French.)

Chermes nordmannianae, Eckstein (*Dreyfusia nüsslini*, Börner) has in the past ten years become the most important pest of the silver fir, *Abies alba* (*pectinata*), in the forests of Switzerland, and an attempt is being made to ascertain its exact distribution there. In order to assist in its recognition, the author reviews the literature on the classification of Chermesine Aphids and describes the morphological characters of the young sistentes (the most easily distinguished stage) of various species that occur in Switzerland. *C. nordmannianae* infests the trunks and crowns of the trees and causes the needles to curl downwards and turn yellow. The crowns are also infested by *Mindarus abietinus*, Koch, which causes the needles to bend upwards, and the trunks by *C.* (*D.*) *piceae*, Ratz. Mixed infestations of the trunks by *C. nordmannianae* and *C. piceae* have been observed [*cf. R.A.E.*, A **33** 194], and the identification of the species in such cases is discussed. Investigations in 1940–45 on the occurrence of *C. nordmannianae* in various localities in Emmental are described [*cf.* **28** 55 ; **33** 194] ; it did not appear to be present in a forest district near Thun that was visited in July 1944, though the climate was favourable and *C. piceae* fairly common. In tests in which single trees or groups of trees were sprayed or dusted with various proprietary preparations in summer or autumn, the results were usually unsatisfactory, though tar distillates gave good control on the trunks.

PRYOR (M. G. M.). **On the hardening of the Ootheca of** *Blatta orientalis*.—*Proc. roy. Soc.* (B) **128** no. 852 pp. 378–393, 28 refs. London, 1940.

The following is the author's summary. The series of reactions concerned in the hardening and darkening of the ootheca of *Blatta orientalis*, L., have been studied in the hope that they may throw some light on the hardening of the cuticle of insects in general. The ootheca is secreted by two glands, of which one secretes a water-soluble protein, and the other a dihydroxyphenol. After secretion, the phenol is oxidised, probably by an enzyme, to the corresponding quinone, which then combines with the protein by a reaction similar to that involved in the tanning of collagen by benzoquinone. This results in the introduction of primary valence cross-linkages into the protein net-work, so that it becomes rigid and very resistant to most chemical reagents and enzymes. The protein of the mature ootheca is more stable than keratin, and represents a new type of scleroprotein for which the name " sclerotin " is proposed.

PRYOR (M. G. M.). **On the hardening of the Cuticle of Insects.**—*Proc. roy. Soc.* (B) **128** no. 852 pp. 393–407, 1 pl., 28 refs. London, 1940.

The following is taken from the author's summary. The hardening of the insect cuticle, which was studied chiefly in larvae and pupae of *Ephestia kuehniella*, Zell., and puparia of *Calliphora erythrocephala*, Mg., is due to the formation of a protein similar to that of the cockroach ootheca [see preceding abstract]. A water-soluble protein and a dihydroxyphenol are secreted into the outer layers of the cuticle, and oxidation products of the phenol there react with the protein to form sclerotin. A similar reaction takes place in the epicuticle, which is secreted as a protein membrane and is subsequently " tanned " by the introduction of aromatic cross-linkages. After it has been converted to sclerotin in this way, the epicuticle is impregnated with lipids, which oxidise and polymerise until they become insoluble in fat solvents. The phenol that takes part in the reaction to form sclerotin is probably dihydroxyphenol-acetic acid, or some very similar compound ; the phenol in the blood, which is responsible for melanosis after death or at the site of injuries, will not react with protein *in vitro*, and so cannot be directly concerned in the formation of sclerotin. The blood phenol appears to be dihydroxyphenol-alanine, which is transported in the blood from some organ where it is synthesised to the cells of the hypodermis, where it is deaminated and converted to the phenolic component of sclerotin.

DENNELL (R.). **Insect Epicuticle.**—*Nature* **155** no. 3940 p. 545, 7 refs. London, 1945.

Some insects are affected by an inert dust that absorbs the epicuticle wax film [*R.A.E.*, A **33** 157] and others by a powder that abrades it [**33** 188], but it was found that larvae of *Sarcophaga* are affected by neither. Histological examination of the cuticle showed that lipoid substances are confined to a very thin layer on the surface of a thin (4μ) protein epicuticle. This surface layer, unlike the rest of the cuticle, is insoluble in cold concentrated hydrochloric acid and can therefore be isolated by this means. Since it is still stained by Sudan Black B [a fat stain] after prolonged treatment with lipid solvents, it is considered to be a constituent layer of the cuticle and to consist of a very stable lipo-protein complex. The bulk of the protein epicuticle does not stain readily with Sudan Black B and is almost completely untanned [see preceding abstract]. A similar double epicuticle is present in *Periplaneta*, which also possesses an external layer of labile fatty substance. Lipoids may thus be associated with insect cuticle in one or more of a number of ways. They may be present as a readily removable surface layer ; they may form a complex with the surface of the epicuticle so as to produce a distinct structural layer ; and they may impregnate the whole of the epicuticle where this layer is tanned. These variations in distribution must influence the effectiveness of inert dusts against different insects.

BUSVINE (J. R.). **Insecticidal Action of D.D.T.**—*Nature* **156** no. 3954 pp. 169–170, 4 refs. London, 1945.

The remarkable insecticidal power of DDT has been attributed to the combined action of a toxic component and one conferring lipoid solubility, but some consider the linked parachlorbenzene rings to be the toxic component and the chloroform residue to be responsible for solubility [*R.A.E.*, A **33** 137], whereas others suggest that the chlorbenzene rings confer lipoid solubility and that the rest of the molecule is responsible for toxicity by liberating hydrogen chloride at the vital centres [**34** 255]. In order to investigate these theories, DDT and several analogous compounds were compared by determining their toxicities to *Cimex lectularius*, L., and *Pediculus humanus*, L., when applied as sprays in white oil, their rates of hydrolysis measured as the percentages of molecules from which HCl had been split off in a given time, and their solubilities in olive oil and white oil. The results are given in a table. DDT was the most toxic to both insects and was also the most rapidly hydrolysed, and indications were obtained of an inverse relationship between the toxicity of the compounds and their solubility in oils. The higher toxicity of the less soluble compounds might be explained by their higher degree of saturation in the carrier, and hence in the cuticular waxes and lipoids in contact with it, but if so, it would be expected that some of the differences in toxicity would disappear if the compounds were used as dry films or saturated solutions. When, however, *P. humanus* was confined on filter paper impregnated with saturated solutions of the compounds in white oil, they showed the same order of toxicity as in the spray experiment, and the times required for 50 per cent. mortality differed widely. The author concludes that the data so far available are insufficient for the formulation of a theory explaining the action of DDT.

HURST (H.). **Enzyme Activity as a Factor in Insect Physiology and Toxicology.**—*Nature* **156** no. 3955 pp. 194–198, 13 refs. London, 1945.

The toxicity of an insecticide may be related not only to its molecular structure, but also to the carrier in which it is dissolved, since this may alter the permeability of the insect cuticle and modify access to internal tissues [*R.A.E.*, A **34** 85]. The importance of this rate factor in access becomes apparent on the valid assumption that insecticidal activity is associated with some disturbance in the consecutive vital processes that regulate the dynamic balance in the internal tissue metabolism [*cf.* **33** 257]. The identification of biological responses such as paralysis or death with specific changes in enzyme activity would assist in the elucidation of the mode of action of compounds in which there is no apparent coincidence between molecular structure and insecticidal activity.

These concepts are illustrated in the present paper in which are defined the bio-physical factors that influence the uptake of insecticides by the cuticle and internal tissue receptors (a term used to indicate the sites of action in biological systems with which drugs are supposed to combine or exert specific actions). Some new factors in insecticidal activity are described, depending on the discovery that the oxidation by enzymes of phenols in the cuticle and sensitive tissue receptors may be greatly modified by the selective environmental influence of the structural components associated with the enzymes *in vivo*. Narcosis, or knock-down action, may involve the indirect blocking of enzyme activity by the adsorption of insecticide on the protective lipo-protein components of the tissues. Lethality usually involves an irreversible increase in the phenoloxidase activity owing to the displacement of protective lipoid from the tissue receptor complex. This stage is accompanied by the accumulation of toxic quinonoid metabolites in the blood and tissues, and is characteristic of the lethal action of insecticides and the simpler fat-soluble drugs. The similarity of action of DDT and the pyrethrins, which differ completely in molecular structure, is unlikely to be related to primary insecticide and tissue combination, but may indicate a coincidence in the dynamic chain of metabolic changes initiated at different links in the chain. The relative susceptibility of insects to contact insecticides depends partly on the permeability of the cuticle, but more fundamentally on the stability of the internal tissue receptors that regulate the internal balance in oxidative metabolism.

WATSON (M. A.). **The Transmission of Beet Mosaic and Beet Yellows Viruses by Aphides ; a comparative Study of a non-persistent and a persistent Virus having Host Plants and Vectors in common.**—*Proc. roy. Soc.* (B) **133** no. 871 pp. 200–219, 1 graph, 15 refs. London, 1946.

The following is largely the author's summary of the part of this paper dealing with investigations on the transmission by *Myzus persicae*, Sulz., of the viruses of mosaic [*Marmor betae* of Holmes] and yellows of sugar-beet. With the mosaic virus, the Aphids are most infective when they have fed for only a few minutes on the infected plants after a period of fasting. After infection feeding, infectivity is rapidly lost when the Aphids feed on healthy plants, but while it remains, a single example can infect several plants. Infectivity is lost much more slowly when the Aphids fast after infection feeding. In this behaviour, and also in its physical properties, the virus resembles other

Aphid-transmitted viruses of the non-persistent group [*R.A.E.*, A **29** 26], but it differs from them in some secondary characters more than they differ from each other. It is retained longer by fasting vectors, and infectivity of the Aphids may increase considerably with increasing infection feeding time in the absence of preliminary fasting, though it rarely reaches the optimum level.

With yellow virus, infectivity of the vector is not affected by preliminary fasting, but always increases with increased feeding time on both infected and healthy plants. Infectivity increases with increasing feeding time on the healthy plants whatever the infection feeding time, and therefore there is always a delay in the production of optimum infectivity by the Aphids after cessation of infection feeding. Infectivity is lost more rapidly from the fasting than from the feeding vectors. The properties indicate that yellows belongs to the persistent group of viruses, although its persistence in the fasting vectors is only about the same as that of mosaic, which is non-persistent. The main basis of distinction between the two types seems not to be the time for which they are retained by vectors, but the effect of preliminary fasting.

In an experiment in which pairs of *M. persicae* or *Aphis fabae*, Scop., some of which were first starved for 16 hours, were allowed to feed on young sugar-beet plants infected with both diseases for 5 minutes, 1 hour or 24 hours and then transferred to four successive healthy plants on which they fed for consecutive periods of 10 minutes, 2 hours, 24 hours and 24 hours, respectively, less than 1 per cent. of the healthy plants became infected with both viruses. Both Aphids transmitted mosaic to the greatest number of plants after preliminary fasting and an infection feeding period of 5 minutes, and more plants became infected after an infection feeding period of 24 hours than of one hour ; the virus was transmitted only to the first of the healthy plants in most series and never to the third or fourth. Very few plants became infected with yellows after the shorter infection periods, but after one of 24 hours, the second of the four healthy plants became infected in some series and the third in still more. *M. persicae* was the more efficient vector in every case. The author shows how this procedure can be simplified to separate viruses from a complex. The requirements are a preliminary fasting period of 12–16 hours, infection feeding periods of 2–5 minutes and 24 hours, and successive feeding periods on healthy plants of about 10 minutes, 2–3 hours, 24 hours and 24 hours. The first two feeds on the healthy plants eliminate any non-persistent virus from the Aphids, and if it is suspected that the infection subsequently obtained is due to more than one virus, the persistent viruses could be separated by consecutive experiments with varying feeding periods, for the period of delay in production of optimum infectivity during test feeding time varies very much with different persistent viruses. It is unlikely that the method could separate non-persistent viruses from one another, since their behaviour in the vector is too similar.

DONCASTER (J. P.). **The Shallot Aphis,** *Myzus ascalonicus* **sp. n. (Hemiptera, Aphididae).**—*Proc. R. ent. Soc. Lond.* (B) **15** pt. 3–4 pp. 27–31, 7 figs., 3 refs. London, 1946.

Descriptions are given of the apterous and alate viviparous females of *Myzus ascalonicus*, sp. n., with notes on its classification. It was first recorded in December 1941, when apterae were found damaging shallots in storage in Lincolnshire ; both apterous and alate viviparae have since been frequently found in many parts of Britain, but the sexuales are not known. It occurs commonly on stored bulbs of shallots and onions during the winter, and a severe infestation has been recorded on stored tulip bulbs. Onions and allied plants are infested at all stages of growth, and other food-plants [see next abstract] include strawberry and a number of ornamental flowering plants and weeds. The Aphid has been found on plants only in winter and spring, but has been maintained on onions and shallots throughout the year in the laboratory.

DONCASTER (J. P.) & KASSANIS (B.). **The Shallot Aphis,** *Myzus ascalonicus* **Doncaster, and its Behaviour as a Vector of Plant Viruses.**—*Ann. appl. Biol.* **33** no. 1 pp. 66–68, 1 pl., 5 refs. London, 1946.

Myzus ascalonicus, Doncaster [*cf.* preceding abstract] is of potential importance as a pest of shallots and onions in Britain. It feeds on the scale leaves under the outer skin and on the young shoots of the stored bulbs and is often sufficiently numerous to render them unfit for planting. Infestation, sometimes severe, has been found on winter lettuce in glasshouses in Bedfordshire and Lincolnshire in February and March, and in April 1943 alates were observed migrating from infested lettuce to onion seedlings in a glasshouse. A heavy infestation occurred on cabbage seedlings in a heated glasshouse and spread to weeds, including *Stellaria media* ; other weeds attacked under glass are *Polygonum persicaria* and *Taraxacum officinale.* The Aphid passes the winter in the apterous viviparous stage in stores and glasshouses, and has occasionally been found on plants out of doors in early spring. During studies of Aphid migrations in 1942–44, adhesive traps were set up in 14 localities in Hertfordshire, Essex, Bedfordshire, Lincolnshire, Nottinghamshire, Shropshire, Devon and Cornwall and at Edinburgh and Dundee, and alates of *M. ascalonicus* were taken at all of them ; they occurred in each year in May–June and again during the second half of October and early November.

The apterous and alate viviparae, which are briefly described, superficially resemble those of *Myzus persicae,* Sulz. Quantitative tests were made to compare the effectiveness of the two species as vectors of eight virus diseases of plants. Six of these were non-persistent [*cf. R.A.E.*, A **29** 26], and the Aphids used in tests with them were starved for 4 hours and then allowed to feed on infected leaves for 2–5 minutes ; in tests with the other two, the Aphids were allowed to feed on infected leaves for a day. After feeding, the Aphids were transferred to healthy plants, which were fumigated 24 hours later. Both species transmitted cucumber virus 1 [*Marmor cucumeris* var. *vulgare* of Holmes] and *Hyoscyamus* virus III to tobacco and sugar-beet yellows to sugar-beet, *Myzus ascalonicus*, but not *M. persicae*, transmitted dandelion yellow mosaic [**34** 70] to lettuce, and *M. persicae*, but not *M. ascalonicus*, transmitted potato virus Y [*Marmor cucumeris* var. *upsilon* of Holmes] and severe etch [*M. erodens* var. *severum* of Holmes] to tobacco, lettuce mosaic [*M. lactucae* of Holmes] to lettuce, and sugar-beet mosaic [*M. betae* of Holmes] to sugar-beet.

BAWDEN (F. C.) & KASSANIS (B.). **Varietal Differences in Susceptibility to Potato Virus Y.**—*Ann. appl. Biol.* **33** no. 1 pp. 46–50, 9 refs. London, 1946.

It has been observed that commercial varieties of potato grown in the same district degenerate at different rates and often as a result of different virus diseases, and experiments were carried out in glasshouses and in the field in England in 1942–43 in an attempt to determine whether these variations are due to true differences in susceptibility or to factors such as differences in attractiveness to Aphids. The transmission of potato virus Y [*Marmor cucumeris* var. *upsilon* of Holmes] by *Myzus persicae*, Sulz., and by mechanical inoculation was studied in the glasshouse, and the results showed that different varieties develop different symptoms when infected with this virus and also differ in their susceptibility to infection, in the concentration of the virus attained in their sap, and in their ability to serve as sources of virus for *M. persicae*. Infested plants of some varieties that are fairly resistant to infection develop a high concentration of the virus and become potent sources of infection. The American variety Katahdin was the most resistant of those tested, but British commercial varieties also showed significant differences in susceptibility. No significant differences in infestation by Aphids were noted in the field in either year. The order of susceptibility of different varieties to infection by virus Y, as indicated by the occurrence of severe mosaic in them, was in general the same as that in the glasshouse. It is suggested that the relative susceptibility of varieties in the open can be assessed from tests made under glass with small numbers of tubers, which are described ; such tests could be used in studies of the inheritance of this type of resistance and of the behaviour of new seedlings. *Aphis rhamni*, Boy, was present in the field as well as *M. persicae*, but did not appear to transmit potato virus Y to any extent, although it has been shown to be as effective a vector as *M. persicae* under experimental conditions [*R.A.E.*, A **30** 501]. Resistance to infection with potato virus Y was not correlated with resistance to leaf-roll [*Corium solani* of Holmes].

PRENTICE (I. W.) & HARRIS (R. V.). **Resolution of Strawberry Virus Complexes by means of the Aphis Vector** *Capitophorus fragariae* **Theob.**—*Ann. appl. Biol.* **33** no. 1 pp. 50–53, 1 pl., 18 refs. London, 1946.

Since the symptoms of the crinkle and yellow-edge diseases of strawberry [*Marmor fragariae* and *M. marginans* of Holmes] vary in severity, it has been suggested that these diseases may be caused by mixtures of viruses or virus strains. In experiments begun in 1942 and described in this paper, an attempt was made to separate them by making use of differences in their relationships to the vector [*cf. R.A.E.*, A **35** 205]. A stock of *Capitophorus fragariae*, Theo., a known vector of these diseases, was raised on cultivated strawberry or wild strawberry (*Fragaria vesca*) believed to be uninfected, and after a fasting period of about 18 hours, the Aphids were transferred to plants infected with mild crinkle, severe crinkle or yellow-edge, on which they were left for periods of 5 minutes, 1 hour or 24 hours, and then to successive healthy plants of *F. vesca* or cultivated strawberry (variety Royal Sovereign). The symptoms produced on *F. vesca* were chlorotic speckling, distortion and dwarfing of the leaves, varying in intensity, and on Royal Sovereign, scattered, inconspicuous, diffuse, chlorotic spots. The symptoms from all three sources of infection were similar and were indistinguishable from those of the mild crinkle of Harris & King. The virus thus selectively transmitted is tentatively concluded to be that of mild crinkle. It was transmitted after feeding periods on the infected plants of one hour or more and did not generally persist in the vector for more than three hours. In other experiments, preliminary fasting did not appear to affect transmission, and this virus therefore does not conform to the characters of non-persistent viruses [**35** 205], but resembles dandelion yellow mosaic [**34** 70] in its relationship to its vector.

WRIGHT (D. W.) & ASHBY (D. G.). **Bionomics of the Carrot Fly** (*Psila rosae* **F.**) **I. The Infestation and Sampling of Carrot Crops.**—*Ann. appl. Biol.* **33** no. 1 pp. 69–77, 8 figs. London, 1946.

A method of sampling carrot crops to determine the degree of infestation by *Psila rosae*, F., is described. It was found that for fields up to ten acres in area, samples of 50 carrots taken at evenly spaced points in alternate twos and threes in midfield and in twos on the headlands, which are generally more heavily attacked, provide a reliable measure ; for larger fields, the number of carrots should be doubled. The distribution of infestation in a single field was studied by taking samples along one headland and along lines parallel to it at distances of 5, 15, 30, 40 and 50 yards into the field, and plotting the percentage attack at each distance against the distance from the headland. The resulting curve is referred to as a headland transect. The three-dimensional figure obtained by combining two such curves for adjacent sides of a field illustrates the gradual decrease in infestation towards the centre and the very high infestation in the corner where the effect of two headlands overlap. If infestation at the headlands is high, infestation in mid-field will also be high in small fields, though it may be low in large ones.

The progressive increase in damage to the roots during autumn and winter was studied in 1941–43, by periodical sampling in fields and plots in eastern England, the percentage attack, the percentage of unmarketable roots, and the number of mines per 100 carrots being determined in each case. The number of mines due to second-generation larvae increased between August and December and then remained almost constant, since most of the larvae had ceased active feeding. The percentage attack also increased until December, and the rate of development of attack throughout the autumn was practically constant at all levels of infestation. The percentage attack was closely correlated with the number of mines per 100 carrots, and the total damage in a sample can therefore be determined from the former alone. Since a root becomes unmarketable when one-third of it is damaged, the number of mines necessary to render it so depends on its size ; for roots weighing over 8, 4–8 and less than 4 oz., these numbers are 9–15, 5–8 and 1–4, respectively. In assessing the fitness of a crop for sale, the limiting factor is therefore the size of the roots, and not the total crop weight. A method of predicting deterioration, based on these data and successfully employed in East Anglia in 1944, is described. The percentage of marketable roots on any date up to about the end of the year is estimated from the percentage attack in samples taken from the headlands and mid-field in the last week of September or early October, and by using graphs showing the increase in percentage attack with time, the relationship between percentage attack and number of mines and the relationship between number of mines and fitness for sale.

The variation in intensity and distribution of attack over a field must result from variations in the distribution of ovipositing adults, and this is largely determined by the kind of shelter available and its position. The relative effectiveness of different types of shelter was studied by means of headland transects based on the numbers of mines per 100 carrots, and recommendations for control based on the results are given. The sides of hedges should be kept well trimmed and hedge-bottoms kept clear of low-growing vegetation. Ditches, banks, etc., bordering carrot fields should be kept as free as possible from tall thick vegetation. Carrot fields should be as large as possible and should not be situated next to potato fields, which provide excellent shelter.

THOMAS (D. C.). **A Study of the Distribution of the Swede Midge** (*Contarinia nasturtii* **Kieffer**) **in Devon and Symptoms of its Attack on various Host Plants.**—*Ann. appl. Biol.* **33** no. 1 pp. 77–81, 1 pl., 2 maps, 7 refs. London, 1946.

A study was made in 1942–44 of the distribution and incidence of *Contarinia nasturtii*, Kieff., on cruciferous crops, notably cow cabbage and swedes in Devon, where infestation by this Cecidomyiid appears to be increasing. The course of infestation indicates that there are three main generations each year, produced by adults that emerge in June, July and August, and two smaller ones, produced in early crucifers by adults that emerge in May and in autumn-sown spring cabbage and late-sown rape by adults that emerge in late September. Since cow cabbage requires rather more than a year to mature, it can be attacked by at least five generations during its growth. Most growers plant seedlings raised elsewhere ; two of the three main areas in which young plants are raised are in Devon, and as *Contarinia* occurs in both, it may be disseminated over the county in this way. The intensity of infestation on swedes is probably related to the date of sowing, the earliest sown crops being the most attacked. The damage caused to swedes, turnips, rape, various types of kale, cabbage, broccoli and cauliflower is described. Observations in 1944 showed that secondary side shoots are produced in swedes only when the larvae are sufficiently numerous (about 13–15 per plant) to cause severe damage to the main growing point. Turnips are less severely attacked, even in pure stands, and damage to rape is less common and of little economic importance in Devon. The symptoms on kale vary with the variety and may involve considerable stunting. On cabbage, attack results in the distortion of the central leaves, which almost cease to grow and may not develop at all in unfavourable weather, particularly drought. Even if the central shoot recovers, the heart produced is of poor quality, and losses are considerable, especially among savoys. Spring cabbage sown in autumn may be attacked by two generations, but recovers more readily than other kinds, probably owing to the rapid vegetative growth in spring and the relatively small size of the over-wintered generation. Attack on cauliflower and broccoli causes loss of curd. Early autumn cauliflower appears to be more susceptible than late broccoli, but losses to early broccoli can be considerable in areas of intensive production [*R.A.E.*, A **28** 39].

Surveys showed that infestation of cow cabbage is more severe in the north-west than in the south and east of Devon, and that swedes are more severely attacked in the south and east than in the north and north-west. These differences are tentatively attributed to the existence of biological races that are specific to different food-plants and to differences in climate and farming practice. Investigations in fields of both crops showed that infestation is normally highest near the headlands and lowest in the centre of the field.

Solomon (M. E.). **Tyroglyphid Mites in stored Products. Ecological Studies.**—*Ann. appl. Biol.* **33** no. 1 pp. 82–97, 4 figs., 21 refs. London, 1946.

The following is largely taken from the author's summary. The ecology of Tyroglyphids in stored products, particularly wheat, was studied by examining samples from storehouses in various parts of England. The moisture content and the numbers of mites in each sample were determined and in many cases extensive temperature data were available. All the wheat was imported and its moisture content when placed in storage was below 13 per cent., which is too low for the development of heavy infestations, and often below 12 per cent., which is too dry to support Tyroglyphids.

Manitoba wheat stored in bulk in one granary was repeatedly examined for 15 months, and examination of infested grain in other granaries provided corroborative data. The chief mite pest of grain is *Tyroglyphus farinae*, Deg. In imported grain, it usually attacks only those parts of a bulk that have taken up extra moisture from damp walls, the atmosphere, etc. *Glycyphagus destructor*, Schr., is commonly found throughout the surface layer of a bulk of grain ; it feeds on dust and fine particles and does not damage the grain. Differences were found in the distribution and population density of *Tyroglyphus*, *Glycyphagus* and the predacious mite, *Cheyletus eruditus*, Schr., in relation to the moisture content of the grain. The population density of all three increased with the moisture content, but the increase was much the greatest for *Tyroglyphus* and was very slight for *Glycyphagus* at moisture contents of over 14 per cent. *Cheyletus* occurred without the other species at a moisture content of less than 12 per cent., more frequently than either at 12–13 per cent., and less frequently than *Tyroglyphus* only at over 15 per cent.

Tyroglyphus was abundant in winter and spring, but was often reduced to very small numbers during summer and autumn. This was due to *Cheyletus*, which was nearly always associated with it and maintained a moderate population density throughout the year. *Tyroglyphus* is known to multiply less rapidly as the moisture decreases ; and the drier conditions in the grain during summer and autumn enabled *Cheyletus* to control it. A subsidiary factor was the migration of *Tyroglyphus* into somewhat drier grain after dense populations had exhausted the available food (wheat germ) in the damper material. Extremely high moisture contents occasionally appeared to cause similar migrations. Seasonal differences in temperature may also have affected the relations of predator and prey, but if so their effect was masked by other factors. *Cheyletus* was also associated with *Glycyphagus*, but did not reduce its numbers to a comparable extent. Hence *Glycyphagus* assisted the distribution and maintenance of *Cheyletus* populations.

Grain stored in bags has a much larger area exposed to atmospheric moisture, so that infestations tend to be more widespread than in bulk grain. Concrete floors at ground level tend to cause extra moisture at the bottom of a stack of bagged grain and in any loose grain on the floor, thereby providing conditions favourable for *Tyroglyphus*. Hence it is important to keep the bags away from the floor by the use of dunnage. *Cheyletus* is less common in bagged grain and in flour. Observations on flour in bags gave similar results and showed that mites tended to concentrate close to the surfaces of the bags, very few penetrating more than a few centimetres into the flour even where there was no gradient of moisture content. This is attributed, at least in part, to mechanical resistance due to tight packing and lumping of the flour. Infestation generally spreads upwards from the floor. Observations on other products showed that heavy infestation of raisins and dried apricots by *Carpoglyphus lactis*, L., was associated with an increase in moisture content.

The most effective means of preventing the infestation of stored products by Tyroglyphids is to keep them moderately dry, so that the mites cannot live in them. Failing this, steps should be taken to prevent local increases in moisture, which favour Tyroglyphids. It might be useful in certain circumstances, such as immediately after fumigation, to introduce *Cheyletus*, perhaps with *Glycyphagus* as a source of food, into stored products, to prevent the possibility of *Tyroglyphus* becoming re-established in a favourable environment without the predator.

PARKIN (E. A.). **The Toxicity of certain aliphatic chlorinated Hydrocarbons to** *Calandra granaria* **L. and other Insects infesting Grain.**—*Ann. appl. Biol.* **33** no. 1 pp. 97–103, 1 fig., 11 refs. London, 1946.

The following is almost entirely the author's summary. An account is given of the biological data obtained during an investigation into the possibility of using certain aliphatic chlorinated hydrocarbons for the fumigation, especially on farms, of small numbers of empty grain sacks infested by insects. A mixture of 3 parts (by volume) ethylene dichloride with 1 part tetrachlorethylene proved far more toxic to adults of *Calandra granaria*, L., than mixtures of 3 parts ethylene dichloride or 2 parts tetrachlorethylene with 1 part carbon tetrachloride. Among seven species of insects likely to occur in empty sacks, the resistance of adults of *C. granaria* to the first mixture was exceeded only by that of larvae of *Trogoderma granarium*, Everts. Its toxicity to *C. granaria* was determined over a range of concentrations and periods of exposure: at 20°C. [68°F.] and 70 per cent. relative humidity, a product of concentration × time of about 1,500 mg.-hours per litre was required for 100 per cent. kill. These results were confirmed by inserting tubes containing weevils into bundles of sacks, which were then exposed to the fumigant in a steel bin. The toxicity to adults of *C. granaria* of mixtures containing different proportions of ethylene dichloride and tetrachlorethylene increased as the proportion of ethylene dichloride increased. The toxicity of tetrachlorethylene to the weevils was very low in relation to that of ethylene dichloride. Since the danger of inflammability when ethylene dichloride is used alone arises only when the concentration lies between 6·2 and about 12·4 per cent. by volume in air, and the lower concentration, corresponding to 255 mg. per litre at 20°C., is considerably higher than any likely to be required for the fumigation of sacks, further experiments were made with this material alone. It was found that the products of concentration × time required to give 100 and 50 per cent. mortality of adults of *C. granaria* at 20°C. were about 1,100 and 490 mg.-hours per litre, respectively. The products required for 50 per cent. mortality at 10, 15, 20 and 25°C. [50, 59, 68 and 77°F.] were in the proportion of 3·0 : 2·0 : 1·0 : 0·7. Sacks would normally be exposed for 48 hours, and a concentration of 23 mg. ethylene dichloride per litre would then be required.

Weevils that recovered from severe narcosis caused by the 3 : 1 mixture of ethylene dichloride and tetrachlorethylene laid viable eggs.

DICKER (G. H. L.). **Apple Blossom Weevil and its Control by D.D.T.**—*Ann. appl. Biol.* **33** no. 1 pp. 124–125. London, 1946.

Dusts of DDT in a mixture of china clay and gypsum were very effective against overwintered adults of the apple blossom weevil [*Anthonomus pomorum*, L.] in the laboratory, whether applied directly to the insects or to the food materials. Toxicity increased with the concentration of DDT, a dust containing 5 per cent. DDT giving an average mortality of 90 per cent. for all tests. Benzene hexachloride at the same concentration killed about 60 per cent. of the weevils exposed to it ; the number of dead or paralysed weevils remained constant after about 16 hours, whereas mortality caused by DDT increased steadily for two days and then more gradually for about another three. In field trials in southern England in 1944, the percentage of capped blossoms was 0·02 on apple trees dusted with 5 per cent. DDT at a rate of 60–70 lb. per acre on 8th, 13th and 20th April, as compared with 4·1 and 6·6 on untreated trees at each end of the plot. A 1 per cent. rotenone dust applied to another plot apparently reduced the number of capped blossoms by 50 per cent. In 1945, the percentages of capped blossoms on trees dusted on both 17th and 23rd March were 0·7 and 6·1 for 5 and 3 per cent. DDT, respectively, at rates of 40–45 lb. per acre, and 16·8 on the controls, but in another test in which 3 per cent. benzene hexachloride gave 50 per cent. reduction in capped blossoms, 3 per cent. DDT produced no noticeable effect. The dust recommended is therefore 5 per cent. DDT, applied at bud-burst and again a week later. Coccinellids are still scarce at that season, and preliminary observations indicated that the toxicity of the dust to them did not persist for more than about 11 days after application.

In laboratory trials, high mortality was also obtained by spraying the weevils with a 0·05 per cent. suspension of DDT in water and by dipping shoots in the suspension, allowing them to dry and placing them in cages with healthy weevils. In one instance, the dipped shoots remained toxic for three weeks.

COHEN (M.). **Experiments with D.D.T. Smokes.**—*Ann. appl. Biol.* **33** no. 1 pp. 125–126, 1 ref. London, 1946.

Experiments are described in which paper was impregnated with DDT and burnt to produce smoke, the toxicity of which was tested against various insects. Blotting or filter paper was soaked in an acetone or benzene solution of DDT, dried, soaked in a 5 per cent. solution of potassium nitrate to ensure even smouldering, and re-dried at 50°C. [122°F.]. The prepared paper was ignited in a closed cylinder, 18 cm. long and 4 cm. wide, by contact with an electrically heated resistance wire. A heavy smoke, almost all of which settled in 20 minutes, was produced. Samples of smoke taken up in benzene that was then evaporated gave a crystalline residue with the same melting-point as DDT. Mosquitos, flies, thrips, clothes moths and *Meligethes aeneus*, F., exposed to the fumes in the cylinders were all knocked down in 5 seconds ; thrips were able to move their legs again after 10 minutes, but died in 8–9 hours. Aphids exposed in a similar manner ceased feeding and were readily dislodged from the foliage after 5 seconds; numbers of *Capitophorus fragariae*, Theo., were still moving 15 hours later, but were unable to crawl. Smoke from paper impregnated with potassium nitrate only was not insecticidal.

A deposit of minute droplets formed on glass held over smouldering paper impregnated with DDT; when stroked with a camel-hair brush or the feet of insects, it behaved like a supersaturated solution, the tracks being marked by the formation of crystals. The deposits on the inner surfaces of two cylinders in which papers had been burnt were toxic to flies exposed immediately or after 16 days. On the hypothesis that no DDT was lost in combustion, about 0·01 and 0·005 mg. were present per sq. cm. To investigate the deposits obtained in practical fumigation, an outbuilding measuring 5½×4×6 ft. was fumigated with 9 sq. ft. of paper bearing 2·5 gm. DDT per sq. ft. The paper was in 20 sheets set upright on the floor 1 ft. apart. After the fumes had settled, sheets of glass previously arranged on the walls, floor and ceiling and on a bench were removed for analysis. The heaviest deposits of DDT were found on horizontal surfaces or near the floor, the average being 17·7 mg. per sq. ft. In a preliminary experiment, the direct heating of DDT in a greenhouse gave volatile products that were insecticidal but not phytocidal.

Gösswald (K.). **Rassenstudien an der roten Waldameise** *Formica rufa* **L. auf systematischer, ökologischer, physiologischer und biologischer Grundlage.** [Racial Studies of the Red Forest Ant, *F. rufa*, on a systematic, ecological, physiological and biological Basis.]—*Z. angew. Ent.* **28** pt. 1 pp. 62–124, 9 figs., 4 pp. refs. Berlin, 1941.

In the first part of this paper, the author discusses the subdivision of the species, *Formica rufa*, L., which comprises the three subspecies, *rufa*, *rufo-pratensis*, Forel, and *pratensis*, Retz.; subsp. *rufa* is monogynous, while subsp. *rufo-pratensis* consists of a large (oligogynous) and a small (polygynous) form, to which the names *major* and *minor* are applied. In the following sections, he describes experiments on the reactions of all three subspecies to light and atmospheric humidity and reviews the various types of forest in which subspp. *rufa* and *rufo-pratensis* occur, their habits, with special reference to the organisation of their nests, and their suitability for mass breeding for the control of forest pests [*cf. R.A.E.*, A **33** 16, etc.].

Schwerdtfeger (F.). **Zur Kenntnis der Kiefernschonungsgespinstblattwespe** (*Acantholyda erythrocephala* **L.**). [A Contribution to the Knowledge of *A. erythrocephala*.]—*Z. angew. Ent.* **28** pt. 1 pp. 126–156, 17 figs., 16 refs. Berlin, 1941.

This is a detailed description of observations made in 1940–41 during an outbreak of *Acantholyda erythrocephala*, L., in a pine forest near Schwerin on the Warthe, a short account of which has already been noticed [*R.A.E.*, A **33** 14]. Damage due to this sawfly had been first observed in 1937, when it was confined to a small area. It spread considerably in 1939, and over 5,000 acres were affected by 1940, when infestation was still apparently spreading. In that year, the adults were reported between mid-April and the end of May, with a peak between 2nd and 10th May, eggs and newly hatched larvae were first observed on 3rd and 25th May, respectively, feeding activity was greatest between 17th and 27th June, and the larvae began to enter the soil on 20th June. In the author's observations, large numbers of overwintering larvae were found about 2–4 ins. deep in the soil near the base of the tree-trunks.

The overwintering larvae consist of pronymphs and eonymphs, and these forms had constituted 31 and 69 per cent. of a number of larvae collected on 19th November 1939. In a collection made on 30th March 1940, they represented 32 and 68 per cent. of the overwintering population, so that the proportions had scarcely altered during the winter. Pronymphs kept on moist sand in the laboratory pupated in early April, but eonymphs died. It is assumed, however, from analogy with other sawflies, that only larvae that become pronymphs by autumn pupate in the following spring, the others remaining in diapause. In order to ascertain when development of the pronymph occurred, larvae were collected at monthly intervals from 7th August until 7th December 1940 and on 7th March 1941 ; pronymphs constituted 5 per cent. of the larvae collected in August, 86 per cent. in September and 72–81 per cent. in the subsequent collections.

The pupal stage lasted 6–40 days at temperatures of 21–6·5°C. [69·8–43·7°F.] in a saturated atmosphere. Adult males and females occurred in about equal numbers and survived for 11–16 and 18 days, respectively, at 15°C. [59°F.]. The egg stage lasted 12–15 days at 19·2°C. [66·56°F.] and 25 days at an average of 13·6 [56·48]. At about 20°C. [68°F.], the larvae fed for 14–23 days before entering the soil.

A proprietary arsenical dust was applied in mid-June to two areas by means of an aeroplane [*cf. loc. cit.*] and gave 85 and 100 per cent. mortality of larvae in a week at rates of 22·5 and 45 lb. per acre, respectively.

TAYLOR (T. H. C.). **On the Identity of the Cotton Capsid of Uganda.**—*Bull. ent. Res.* **37** pt. 4 pp. 503–505, 3 refs. London, 1947.

A Mirid that is injurious to cotton in Uganda was known as *Lygus vosseleri*, Popp., prior to 1935 and subsequently as *Lygus simonyi*, Reut., owing to the adoption of the view that *L. vosseleri* is a synonym of *L. simonyi* [*R.A.E.*, A **24** 106]. From a comparison of specimens with cotypes of both sexes of *L. simonyi*, a cotype female of *L. vosseleri* and both sexes, including the female type, of *L. schonlandi*, Dist., the author finds, however, that *L. schonlandi* is a synonym of *L. simonyi*, that *L. vosseleri* is not, and that the cotton Mirid of Uganda is *L. vosseleri* and not *L. simonyi*. *L. simonyi* is common in Uganda on plants other than cotton, but is only a rare visitor on the latter. Poppius, in his list of localities for *L. vosseleri*, included Amani (Tanganyika) and stated that it is injurious there to castor (*Ricinus*). The cotton Mirid is rare in Uganda on *Ricinus*, which is attacked severely by a closely related species. Poppius' description of *L. vosseleri* applied to the cotton Mirid, and not in all respects to this related species.

WRIGHT (D. W.), GEERING (Q. A.) & ASHBY (D. G.). **The Insect Parasites of the Carrot Fly,** *Psila rosae*, **Fab.**—*Bull. ent. Res.* **37** pt. 4 pp. 507–529, 28 figs., 14 refs. London, 1947.

Of the parasites of *Psila rosae*, F., found in carrot fields in East Anglia, the Braconid, *Dacnusa gracilis*, Nees (*postica*, Hal.), and the Diapriid, *Loxotropa tritoma*, Thoms., were widespread, *D. gracilis* being the more numerous. As they were considered potentially important in restricting the increase of *P. rosae*, investigations on their life-history and development were carried out in 1944 and 1945. The larval instars of both are described and figured, and details are given of their distribution and the degree and effect on the host of parasitism by them.

Observations suggested that *D. gracilis* oviposits in host larvae in any instar, but not in puparia. There are two complete generations in the year, coinciding with those of the host, and the winter is spent in the larval or prepupal stages in the host larvae or puparia. Growth appears to continue throughout the winter except when the soil is frozen or nearly so. Pupae were found in March, but as many host larvae did not pupate until March or early April, and the parasite larvae do not moult to the fourth (final) instar until this occurs, pupation of the parasite was not complete until early June. Adults of the two generations emerged between early May and early June and between late July and late August ; the peak of emergence, and usually the beginning of emergence also, were later for the parasite than for the host. The ratio of females to males appeared to be nearly 3 : 2.

L. tritoma had only one generation in the year, the adults emerging between the end of May and the end of June, towards the end of the emergence of the overwintered generation of *P. rosae*. Larvae were found in pupae of the host in July, but remained in diapause in the first instar until the following spring ; experiments are described showing that exposure to low temperature is required to break the diapause. When, however, *L. tritoma* parasitises *Oscinella frit*, L. [*cf. R.A.E.*, A **18** 518], it has two generations a year and no diapause. No morphological differences were found between examples bred in *P. rosae* and in *O. frit*, and for the present, any observed differences in biology may be regarded as an adaptation of the parasite to different hosts. It is assumed that after mating, the female attacks larvae of *P. rosae*, probably in the first instar. Males and females were about equal in numbers. In addition to behaving as a primary parasite of *P. rosae*, *L. tritoma* occurred as a hyperparasite, attacking *D. gracilis*, but the degree of hyperparasitism in relation to the relative numbers of the two parasites suggested that hyperparasitism occurs quite fortuitously. Spraying with an emulsion containing 0·5 per cent. DDT in July and August reduced parasitism by *D. gracilis* [*cf.* **34** 45], but did not affect *L. tritoma*, as the spray was applied after its flight period.

The other parasites observed were a Cynipid of the genus *Kleidotoma* and the Staphylinid, *Aleochara sparsa*, Heer ; pupae of the former and larvae of the latter were found locally and in small numbers in puparia of *P. rosae*. The Staphylinid larvae fed ectoparasitically on the host pupae of the overwintering generation within the puparia, and probably left the host in order to pupate in the soil by the middle of June. They were found in normal overwintering puparia and those parasitised by *D. gracilis*, but not in puparia containing *L. tritoma* or in puparia of the summer generation. The three larval instars are described.

It is concluded from these results that *P. rosae* has reached a relatively stable equilibrium with its parasites and that although parasitism is occasionally heavy, it is never high enough to imperil the survival of a population of the fly.

RIVNAY (E.). **Physiological and ecological Studies on the Species of *Capnodis* in Palestine (Col., Buprestidae). IV. Toxicological Studies.**—*Bull. ent. Res.* **37** pt. 4 pp. 531–542, 7 refs. London, 1947.

In laboratory tests made in 1937–44 on the control by means of insecticides of species of *Capnodis* that attack stone-fuit trees in Palestine [*cf. R.A.E.*, A **34** 369, etc.], neonate larvae were put in slits in the bark of small sections of almond branches 3–6 cm. in diameter and allowed to grow for 4–8 weeks. The infested branches were then tied in bundles and buried 25–30 cm. deep in circles round a small hole in the soil in which the insecticide was applied. The mortality of the larvae was determined 3–5 days later. Ethylene chlorhydrin had little insecticidal value, but ethylene dichloride was more effective, and a series of experiments with it showed that a dosage of 60–100 cc. gives a good kill of larvae within a radius of 20 cm. but not always beyond it ; that 120 and 150 cc. kill most of the larvae up to a radius of 35 cm., but only 20 and 50 per cent., respectively, at a distance of 50–55 cm. ; and that when the dosage is divided and applications are made at four points, mortality is reduced. Pure ethylene dichloride applied in the centre of a small area was as effective as an emulsion containing the same quantity of the compound poured over the surface. No difference in mortality resulted from the use of a cold emulsion (30°C. [86°F.]) and a warm one (65°C. [149°F.]) at the same concentration. The results of field tests carried out by K. Shweig in the Esdraelon Valley are given for comparison. Emulsions containing 10–20 per cent. ethylene dichloride, poured into a circular groove round the tree or over a burlap rag, which was buried round the tree about 10 cm. from the trunk, at the rate of 1·5–2·1 litres per tree, killed about 75 per cent. of the larvae, with no marked difference in mortality when the dosage was increased from 140 to 380 cc. per tree, when the applications were made directly on the soil or over a burlap rag, or when the temperature of the emulsion was raised from 30 to 50°C. [122°F.]. The treatments were less effective against pupae and had no effect on adults. Application of 100 cc. ethylene dichloride in holes near the base of the tree and of 100 or 150 cc. 15 cm. away from it caused no injury in two months to 8-year-old apricot trees grafted on a local apricot variety, and 50 cc. applied in holes near the base of the trunk caused none to 3-year-old almond trees grafted on bitter almond.

Ethylene dichloride was considered unsuitable on account of the large doses necessary for adequate mortality, and tests were therefore carried out with bromine compounds, which were shown to be effective in smaller quantities. A dosage of 10 cc. pure ethylene bromhydrin killed all larvae in branches buried immediately below the point of application and about 66 per cent. of those buried 20 cm. away, and the same quantity mixed with water killed about 66 per cent. of all the larvae. Preliminary tests in 1937 showed that 5 cc. ethylene dibromide killed all larvae 30 cm. deep for a distance of 10–20 cm., and further experiments in 1944 showed that almost complete mortality of larvae in an area of about one square metre may be produced by the application of 20–30 cc. ethylene dibromide to a hole in the centre, whereas mortality is much less if the same amount is applied in four parts ; that 6 cc. gives complete mortality at a distance of 35 cm., and 3–4 cc. a satisfactory kill if the soil is properly prepared ; and that the mortality caused by small dosages is far less in dry soil than in soil that is moist or moistened on the surface.

It was observed that fumes of both the dichloride and the dibromide penetrate through compact layers of soil, but that penetration is far better and mortality higher when the soil is less compact. It is therefore preferable to apply the fumigant after the soil has been cultivated and sprinkled with water. Ethylene dibromide should be applied at the rate of 4 cc. per hole in one hole near the trunk of trees 1–3 years old, in two holes at a distance of 25 cm. on opposite sides of trees 7–8 years old, and in three equally spaced holes 30 cm. from the trunks of older trees. If ethylene dichloride is used, 60 cc. should be applied to trees 2–3 years old and 150 cc. to older ones. Dosages of about twice the size recommended caused no apparent damage to young or old almond trees or to 10-year-old plum trees.

Tests of the effect on larvae of a few chemicals that might be sprinkled dry round trees as a barrier against neonate larvae did not indicate that they would be of any value. Insecticides applied to twigs on which adult beetles were fed did not give high rates of mortality unless the beetles were fed repeatedly on the treated twigs and had no other food, but it is suggested that cryolite, which was as effective as any other insecticide tested and less likely than most of them to injure the trees, might be of value as a spray in the orchard. Possible methods of control other than the use of insecticides include collecting the adults in summer in the early morning, when they are feeding and relatively inactive ; the use of dry sand round the trees as a barrier against the larvae ; and irrigation, where this is possible [*cf.* **33** 384]. Uncovering the root crown of the tree over an area of about 60 cm. square and scraping the roots in search of frass and larvae, once in spring against overwintered larvae and once in autumn to kill those that have developed during the summer, has been practised in Palestine for many years and has been the most important method of preserving the groves, but scraping the roots with a spade or knife is injurious and expensive, especially when each tree, whether infested or not, is treated, and even a trained observer may not find all the larvae that are present.

Sarcophila latifrons, Fall., was reared from small numbers of beetles captured in the field ; the female larviposits on the host, and the parasite larva immediately enters its body. Parasitised beetles do not produce eggs.

Corby (H. D. L.). *Aphanus* **(Hem., Lygaeidae) in stored Ground-nuts.**—*Bull. ent. Res.* **37** pt. 4 pp. 609–617, 11 figs., 13 refs. London, 1947.

The author reports infestation of stored shelled ground-nuts at Yola and Lau in the Adamawa Province of Nigeria by a Lygaeid of the genus *Aphanus* [*cf. R.A.E.*, A **33** 370]. This was identified as *Aphanus littoralis*, Dist., by W. E. China, who considered, however, that *A. littoralis* may prove to be a synonym of *A. sordidus*, F., which has been recorded from harvested ground-nuts in Senegal [*cf.* **5** 339].

The following is based on the author's summary. The infestation occurred in nuts that, owing to war emergency, were kept in stores of mud and thatch ; these buildings were much cooler than the corrugated-iron buildings normally used, which were not infested. This difference in temperature is believed to have favoured the infestation. The bug had not hitherto attracted attention in Nigeria, but was later found to be recognized by native farmers as associated with ground-nut plants drying in the fields at harvest, and was observed in four other provinces. Adults and nymphs suck the oil from the kernels, causing loss of weight and germinative power, and the development of free fatty acids, resulting in a rancid and bitter taste. It was found, however, that the bugs could not penetrate more than about three inches into the bulked kernels, so that damage was not extensive.

The life-cycle lasted about seven weeks, and adults of both sexes lived for an average of 17 days. All stages are described and figured. During the day nymphs and adults were found either inside the stores, congregated on the nuts near the walls, or outside under the coarse grass matting protecting the mud walls against rain, but at night they were scattered thickly on the ground and vegetation searching for moisture. The removal of all vegetation near the stores in order to deprive them of their main source of moisture, or surrounding the store at a distance with damp straw, which should be burned as soon as it has attracted a sufficient number of bugs, is therefore suggested as a possible control measure. Others include storing the kernels in thick bags and spraying with a contact insecticide. *Gryllulus domesticus*, L., and *Gryllodes sigillatus*, Wlk., were observed to feed on the eggs and active stages and may have given some control.

Ferrière (C.). **A Chalcidoid Egg-parasite of an Australian Buprestid.**—*Bull. ent. Res.* **37** pt. 4 pp. 629–631, 1 fig. London, 1947.

The author describes the male and female adults of the Encyrtid parasite, *Ooencyrtus prospheris*, sp. n., reared from the eggs of the Buprestid, *Prospheres aurantiopictus*, Lap., in Queensland in December 1943 and gives a key by which it may be distinguished from all other Australian species described by Girault under *Ooencyrtus*, Ashm., or *Schedius*, How., which is now considered a synonym of *Ooencyrtus*.

Allman (S. L.). **Benzene Hexachloride in Grasshopper Baits.**—*Agric. Gaz. N.S.W.* **57** pt. 4 pp. 171–172, 182, 2 figs. Sydney, 1946.

Benzene hexachloride was compared with sodium arsenite in baits against *Phaulacridium vittatum*, Sjöst., which had been causing serious losses to valuable crops, including cabbage, carrots and raspberries, in the Moss Vale area of New South Wales. The test was carried out in a crop of cabbages that had been abandoned and was proceeded with despite the fact that most of the grasshoppers were adults, since these are mainly wingless and valuable crops need to be protected from them. The baits contained ½ lb. sodium arsenite or 1 lb. of a mixture of 10 per cent. benzene hexachloride (10 per cent. gamma isomer) in pyrophyllite, with 4 lb. molasses, 24 lb. bran and 2½ gals. water, and were distributed late in the morning when the shade temperature was about 80°F. The grasshoppers readily fed on the benzene-hexachloride bait, some were unable to move normally in an hour, and 75 per cent. were dead and many others affected by the poison after 24 hours. The sodium-arsenite bait killed few grasshoppers, even when applied a second time with twice the concentration of sodium arsenite. In a subsidiary test, a dust containing 2 per cent. benzene hexachloride applied to an experimental plot at the rate of 5 lb. per acre was ineffective. It is concluded that benzene hexachloride is of value in baits for protecting crops such as mature cabbages in which feeding by adult grasshoppers on a large scale is necessary to cause loss.

In March 1946, swarms of *Chortoicetes terminifera*, Wlk., were reported in the Moree district, where they caused some damage to pasture. Eggs had hatched in some areas that were flooded in January. The swarms consisted of well-grown hoppers and an appreciable number of newly-emerged adults and the latter formed loose swarms that moved about, but did not migrate in any definite direction. The benzene-hexachloride bait without molasses was applied against several swarms and proved attractive to the grasshoppers, which clustered round it or, when moving into a baited area, stopped and began feeding on it. Some were affected within a few minutes, and a large proportion was incapacitated within an hour.

FRIEND (A. H.). **Cauliflower Seed Crop Pests. Field Experiments with the newer Insecticides. Observations and Results.**—*Agric. Gaz. N.S.W.* **57** pt. 4 pp. 181–182. Sydney, 1946.

The experiments described were carried out in a crop of cauliflowers grown for seed in New South Wales in the season of 1945. The whole crop was sprayed seven times during the period up to curd-maturity with a proprietary preparation of DDT. The first three sprays were diluted to give 0·05 per cent. w/v DDT and were applied to the seed bed; the fourth, which was applied after planting out, contained 0·1 per cent. and caused minor leaf scorch, and the content in the last three was therefore reduced to 0·025 per cent. Adults of *Plutella maculipennis*, Curt., were present throughout the season, and adults of *Pieris rapae*, L., in the seed-bed and during the early growing stages of the crop, after which they disappeared until early August, but at no stage were caterpillars observed on the plants, despite the deposition of many eggs.

Brevicoryne brassicae, L., developed on the crop in early spring, during flowering, threatened the young seed in September and declined with the onset of hot weather in late November. As a heavy application of the DDT spray, diluted to give 0·09 per cent. DDT, gave a poor kill of this Aphid, dusts containing 2·5 per cent. nicotine, 1 and 2 per cent. 666 [benzene hexachloride] or DDT, and 0·5 per cent. of both 666 and DDT (all by weight) were tested against it. They were made by diluting a 5 per cent. commercial nicotine dust and samples of highly refined 10 per cent. DDT and 666 with kaolin. The results were based on ratings made on two occasions. The nicotine dust, applied at the rate of 1 lb. per 10·5 plants, was the most rapid in action and afforded protection for about 18 days. The stronger 666 dust, at 1 lb. per 10 plants, gave the best rating 18 days after application, so that it afforded protection for considerably longer. The weaker 666 dust at 1 lb. per 8·4 plants was of value for at least four days and was superior to either 1 or 2 per cent. DDT. The mixture of DDT and 666 proved no better than 1 per cent. DDT.

Nysius vinitor, Bergr., was observed in early spring on the headlands and occurred on the crops in small numbers in late October, after which it became numerous and remained so well into the summer. Tests were made with the dusts of DDT and 666, and also with sprays of 0·015 and 0·25 per cent. w/v DDT. DDT gave the best results and was slightly more effective as the 2 per cent. dust applied at 1 lb. per 8·5 plants than as the 0·25 per cent. spray at 1 gal. per 10 plants. This dust, at 1 lb. per 6·5 plants, gave field protection for 4–5 weeks, while the 1 per cent. DDT dust applied at the same rate remained effective for about 23 days. The 2 per cent. 666 dust at 1 lb. per 10 plants gave good protection in the early stages, but had no effect after about a month; 1 per cent. 666 at 1 lb. per 8·4 plants gave good protection for about a fortnight, but was completely ineffective after 18 days. The combined dust of DDT and 666 was not superior to 1 per cent. DDT.

Insect Pests.—*Agric. Gaz. N.S.W.* **57** pt. 4 pp. 195–199, 3 figs. Sydney, 1946.

In the course of this part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **35** 191] it is stated that larvae of the sawfly, *Phylacteophaga eucalypti*, Frogg., in the leaves of *Eucalyptus* spp. and *Tristania conferta* [*cf.* **29** 237], can be controlled by a spray containing 1 fl. oz. nicotine sulphate and 8 fl. oz. white oil emulsion in 4 gals. water, repeated if necessary after 2–3 weeks.

WALLACE (C. R.). **Benzene Hexachloride ("666") and D.D.T. applied to the Soil against Black Beetle.**—*Agric. Gaz. N.S.W.* **57** pt. 4 p. 200. Sydney, 1946.

A summary is given of the results of field tests in New South Wales to develop techniques for protecting crops and pastures against adults of *Heteronychus sanctae-helenae*, Blanch., by means of soil treatments with 666 (benzene hexachloride) or DDT [*cf. R.A.E.*, A **35** 35]. Dusts containing 2 per cent. DDT or 2, 0·1 or 0·025 per cent. 666, scattered and stirred into the soil by means of a tine cultivator, failed to protect maize when applied at 300, 200, 455 and 600 lb. per acre, respectively. When dusts of 2, 4 and 6 per cent. DDT or 666 were applied in the same way at 605 lb. per acre, 6 per cent. 666 gave the highest kill of beetles and soil treated with it remained lethal to them for at least three months. There were no ill-effects on the plants from any of the six treatments.

Dusts of 10 per cent. DDT in pyrophyllite and 4 per cent. DDT or 2 per cent. 666, in superphosphate, applied through the fertiliser hopper of a maize planting machine, failed to protect maize sown at the same time, although 666 gave a noticeable kill of beetles. Of six insecticidal dusts that were dropped on the soil and stirred in to form a strip of treated soil about 4 ins. wide and 4 ins. deep in which maize seed was planted, 10 per cent. DDT at 1 lb. per 22 yds. was outstanding, giving almost perfect protection without apparent harm to the plants. In further tests, a small tractor fitted with a fertiliser hopper, tine cultivator unit and seed dropper was used to stir insecticidal dusts into the soil in a strip 10 ins. wide in which maize was sown. Dusts of 2 per cent. DDT in superphosphate or kaolin failed to protect the maize against heavy beetle attack, whereas 2 per cent. 666 in superphosphate gave excellent protection against moderate infestation and caused high mortality of the beetles.

Sprays containing 0·15 per cent. para para DDT, jetted at the soil at the base of maize and cauliflower plants, caused the beetles to emerge from the soil and die at the surface. In rows of maize treated similarly with a spray containing 0·05 per cent. of the γ isomer of 666, the toxic effects persisted for at least a month. Sprays of DDT or 666 applied to maize seed in open furrows and then jetted along the surface soil above the seed after the furrows were filled in gave several weeks' protection.

Pasfield (G.). **Control of Black Peach Aphids** (*Anuraphis persicae-niger*) **by the Use of D.D.T.**—*Agric. Gaz. N.S.W.* **57** pt. 4 pp. 201–204, 2 figs. Sydney, 1946.

In the Young district of New South Wales, *Anuraphis persicae-niger*, Smith, is most active on the aerial parts of stone-fruit trees between June and November. Since the nicotine-sulphate sprays commonly used against this Aphid [*cf. R.A.E.*, A **30** 280] have been found unsatisfactory and uneconomical, experiments with a spray containing 0·1 per cent. DDT were carried out during the season of 1945, when infestation was severe, particularly on peaches, plums and nectarines. The spray was prepared by dissolving 1 lb. DDT (94–96 per cent. para para isomer) in 5 pints solvent naphtha, adding ½ pint of a proprietary wetting agent and diluting in 100 gals. water, and was applied to three comparable groups of seven infested plum and nectarine trees. The first group was sprayed at the dormant, semi-dormant and petal-fall stages (11th July, 8th August and 28th September), the second on 11th July and 28th September only, and the third on 8th August and 28th September. All the trees were sprayed with lime-sulphur (1 : 20) on 27th August. Examination of the trees in the first and second groups 24 hours after the first application showed that about 30 per cent. of the Aphids were dead and the rest almost completely inactivated, but complete mortality did not ensue until 5–10 days after treatment. On 28th August one tree in the second group was slightly infested, but the remainder, and all those sprayed on 8th August, were free from Aphids. On 26th September, two trees of the first group, four of the second and six of the third were slightly infested, but on 17th October, all the trees, except one in the second group, were free from Aphids, and the position had not altered by 31st October. All the trees were uninfested on 12th November, although 8 ins. of rain had fallen since the earliest DDT treatment. Adults and larvae of *Coccinella repanda* var. *transversalis*, F., which had destroyed the seven colonies of Aphids on the tree infested in October, showed no signs of DDT poisoning, and the sprays had no apparent injurious effects on the trees. Control trees were not sprayed until absolutely necessary, plums receiving three applications of nicotine sulphate, on 21st August and 3rd and 25th October, and nectarines two, on the first and last of these dates. The sprays used contained 1 pint nicotine sulphate and 2 gals. oil per 80 gals. water for the first application and 1 pint nicotine sulphate and 3 lb. soap per 75 gals. for the others. The weather was cool on the first two dates and mortality was relatively low, but the third application was made during a warm period and gave almost complete mortality. Similar results were obtained in a neighbouring orchard, in which infestation had been so heavy that some trees were severely damaged and a few killed.

It is concluded that two applications of the DDT spray, the first in late June or early July and the second immediately after petal-fall, will normally protect stone-fruit trees from damage by *A. persicae-niger*, but that if heavier infestations are experienced than those of 1945, an additional application just before or at the early " pinking " stage may be required. It is not thought desirable to spray the trees while in blossom because of possible danger to bees.

Cashmore (A. B.) & Campbell (T. G.). **The Weeds Problem in Australia : a Review.**—*J. Coun. sci. industr. Res. Aust.* **19** no. 1 pp. 16–31, 2 figs., 42 refs. Melbourne, 1946.

Research on the control of noxious weeds in Australia, based on a survey made in 1935 [*R.A.E.*, A **24** 306], was interrupted by the late war, after which it was apparent that the problems requiring study had become more serious and more numerous. The present position is here reviewed, and the lines along which it is planned to conduct research are indicated.

Weeds against which insects have been introduced include *Hypericum perforatum*, against which *Chrysomela hyperici*, Forst., *C. quadrigemina*, Suffr. (*gemellata*, Rossi) and *Agrilus hyperici*, Creutz., have become established [*cf.* **32** 64–65], and *Senecio jacobaea*, against which *Tyria jacobaeae*, L., has not, apparently because it was attacked by native predators, particularly *Harpobittacus australis*, Klug [*cf.* **27** 282]. During 1937–40, *Bactra truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl., which attack *Cyperus rotundus*, were introduced for study into Australia from Hawaii [*cf.* **27** 546] where they at first gave promise of affording some control of this weed but later proved disappointing [*cf.* **31** 46]. *Bactra* is heavily parasitised in Hawaii by *Trichogramma minutum*, Ril., which occurs in Australia. Neither species was liberated in Australia, since it was considered that any insect that fed on *C. rotundus* would also attack related species, such as *C. bifax*, which are useful fodder plants in certain grazing areas. Of the insects that attack *Xanthium pungens* in India and North America and appeared promising, only *Euaresta aequalis*, Lw., proved incapable of feeding on useful plants, such as sunflower and Jerusalem artichoke [*Helianthus tuberosus*]; it was introduced from America and liberated in large numbers in southern Queensland [*cf.* **28** 566], but is not increasing rapidly. In south-eastern Queensland and north-eastern New South Wales, *X. pungens* appears more or less regularly at the same season each year, and the life-cycle of the fly is closely adapted to that of the weed, but in areas of more variable rainfall, germination of the seed is very irregular, and intervals of several years may occur between successive generations of the plants in any particular locality. *E. aequalis* cannot adapt its life-cycle to such conditions and it is unlikely that any other insect can do so. *Teleonemia scrupulosa*, Stål, liberated in Queensland against *Lantana camara* [*cf.* **33** 321, etc.], is now widely distributed in infested areas north of Townsville [**30** 155], but attempts to establish it in coastal districts south of Townsville were less successful [*cf.* **33** 321, etc.], and attempts in New South Wales and on Norfolk Island failed.

Hackman (R. H.). **The Preparation of some Emulsions containing DDT.**—*J. Coun. sci. industr. Res. Aust.* **19** no. 1 pp. 77–85, 2 figs., 6 refs. Melbourne, 1946.

Emulsions of the oil-in-water type containing DDT, required for the control of insects that attack plants and animals, are most easily obtained by diluting concentrates with water until the desired strength of DDT is obtained. The concentrates are either of the soluble-oil type, consisting of a solution of DDT in oil, to which an emulsifier has been added to form a homogeneous solution readily dispersed in water, or of the mayonnaise type, which are concentrated emulsions consisting of solutions of DDT in oil dispersed in water with the aid of an emulsifying agent. The former usually contain a higher proportion of DDT, since no water is present, and are therefore cheaper to transport, and they may be diluted with either water or oils, but require more emulsifier than the mayonnaise type to obtain satisfactory emulsification. Since mechanical force is used in the preparation of mayonnaise concentrates, only relatively small amounts of emulsifier are required and a wider range of materials may be used. Mayonnaise concentrates are not inflammable.

The investigations described in this paper were confined to the preparation of soluble-oil concentrates, but owing to the limited selection of solvents available in Australia, difficulty was experienced in preparing concentrates containing a high proportion of DDT and having the reasonably high flash points necessary to reduce the danger of fire. Tests were carried out with 17 solvents, including some vegetable oils, with anionic, non-ionic and cationic emulsifying agents, and with adjuvants such as glyceryl mono-oleate and aluminium naphthenate, to prevent penetration of the spray solution into the leaf tissue and increase oil deposit. When the emulsifier was not miscible with the solvent, a suitable coupling agent, such as glyceryl mono-oleate, the lower alcohols, cetyl alcohol, lauryl alcohol, cresylic acid or cyclohexanol, was used to effect solution. Dibutyl and dimethyl phthalates, kerosene and the cationic agents were eliminated because they caused injury to plants, and others because they were scarce. As a general rule, 10 per cent. by weight of the emulsifier was included in the concentrate to ensure emulsification with the minimum of agitation. Satisfactory emulsions were prepared with 5 per cent. or less emulsifier, and usable emulsions have been made from concentrates containing as little as 0·3 per cent., but the amount of mechanical agitation necessary for the production of the emulsion is increased as the concentration of emulsifier is decreased. Increasing the amount of an emulsifier that normally is not miscible with the solvent to 20 per cent. or more prevented the undesirable separation of the concentrate into two layers, but generally decreased the amount of liquid retained on the sprayed surface, because of increased run-off, and was more expensive than adding a coupling agent. To obtain satisfactory soluble-oil concentrates, it was found advisable to avoid the use of emulsifiers that are preferentially water-soluble, such as the sodium alkyl sulphates and sodium alkylaryl sulphonates, unless suitable coupling agents were added. Generally, the emulsions are required to be stable for a few hours only, and some agitation is permissible. The specifications of some of the solvents and emulsifying agents used are given in appendices.

One of the best emulsions was prepared from a concentrate consisting of DDT, toluene and an Australian proprietary emulsifying agent (Soaxit) (30 : 60 : 10 by weight). It was extremely stable and showed no tendency to cream, and the oil particles dispersed in the water had a diameter not exceeding 4–5 μ, most of them being much smaller. Reducing the amount of emulsifier in the concentrate to 5 per cent. did not appreciably affect the stability of the resultant emulsion. Other solvents, such as xylene, Shell solvent X6 and oil of *Eucalyptus dives* (typical form) also gave extremely stable emulsions with the same emulsifier.

JARVIS (H.). **Pests of the Mango.**—*Qd agric. J.* **62** pt. 1 pp. 10–14, 2 figs. Brisbane, 1946.

Notes are given on the bionomics and control of the more important insect pests of mango in Queensland. The Coccid, *Chionaspis dilatata*, Green, often occurs on the foliage, causing discoloration and, if numerous, premature leaf-fall. It can be controlled, if the trees are small enough to spray, by a 2½ per cent. emulsion of summer oil. The bionomics of *Ceroplastes rubens*, Mask., on mango are much the same as on *Citrus* [*cf. R.A.E.*, A **24** 35, 134], and it can be controlled by the spray of soap and sodium carbonate used in *Citrus* orchards [*cf.* **29** 437].

Damage by the Noctuids, *Bombotelia jocosatrix*, Gn., and *Peperita euthysticha*, Turn., occurs in northern Queensland, and is severe in some years. The first symptom of infestation by these insects is a wilting of some of the growing tips on the outside of the trees, accompanied by the blackening of the leaves on such twigs ; die-back ensues, and dormant buds on the more mature wood develop and produce a bunched type of growth. It is presumed that the eggs of both species are laid on the young growth, usually in spring, when the damage is most commonly observed ; the larvae bore in the shoots from the tip to the thicker part, where they pupate in silken cocoons. Control measures are difficult to apply, but a lead-arsenate spray or dust in late spring or early summer might prove effective.

The seeds are attacked by *Cryptorrhyncus mangiferae*, F., the larvae of which almost completely destroy the kernels. The adults lay their eggs on the young fruits, usually one on each, and the larvae tunnel into the kernels and feed for several weeks until the fruits are ripe, when they pupate. The pupal stage lasts 1–2 weeks, but the adults may remain in the seeds for several weeks more before escaping. They usually shelter in crevices in the bark or similar places until the following season, so that dispersal must largely be effected through the carriage of infested fruits and seeds. Control of the weevil is impracticable. In propagation beds, seeds should be planted far in excess of seedling requirements in order to offset possible losses, or should be opened with a knife and the sound kernels selected for planting.

Infestation of mango fruits by *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., is often severe and causes premature ripening and fruit-fall. The trees are usually too large for the successful use of traps or bait-sprays [*cf.* **33** 162], but the destruction of fallen fruits should be carried out as a routine measure.

JENKINS (C. F. H.). **Grasshoppers and Locusts in Western Australia.**—*J. Dep. Agric. W. Aust.* (2) **22** no. 4 pp. 322–331, 8 figs., 1 map. Perth, W.A., 1945.

A brief account is given of the bionomics of *Austroicetes cruciata*, Sauss., the most important grasshopper in Western Australia, and the measures employed for its control, together with a summary of the outbreaks that have occurred there since 1922, and a discussion of the factors influencing their occurrence [*cf. R.A.E.*, A **26** 169; **32** 90]. Of the other species present, *Chortoicetes terminifera*, Wlk., *Phaulacridium vittatum*, Sjöst., *Gastrimargus musicus*, F., and *Austracris guttulosa*, Wlk., are the commonest. *C. terminifera* is numerous in summer and often attacks vegetables and ornamental plants. *P. vittatum*, which breeds quite freely in sand, is common in many districts in the south-west, where it sometimes damages market-garden crops, ornamental plants and fruit trees; the outbreaks remain local, however, since the majority of the adults are wingless. *G. musicus* occurs in pastures in which couch grass [*Agropyrum repens*] and *Paspalum* are plentiful and is common in summer in the Harvey-Waroona irrigation districts and along river flats; it is of importance in the summer rainfall areas of the north and outbreaks periodically damage vegetable crops [*cf.* **34** 365]. *A. guttulosa* is fairly common in the south-west, where, however, it does not form outbreak swarms. These occur in the north and in June 1945 they seriously damaged banana plantations at one place. Other food-plants include *Citrus* and *Eucalyptus*. The eggs are laid in December and January and hatch shortly afterwards; the overwintering adults frequently congregate in large masses in the tops of trees.

Long-horned grasshoppers [Tettigoniids] are not of great importance in Western Australia, but may damage ripening fruit.

Replanting of felled coniferous Woodland in Relation to Insect Pests.—*Leafl. For. Comm.* no. 25, 7 pp., 2 figs. London, 1945.

This is a summary of the precautions to be observed when replanting areas in Britain over which woods and plantations of conifers have been felled or burned, so as to prevent infestation of the newly planted trees by *Hylobius* [*abietis*, L.] and *Hylastes* [*ater*, Payk.] [*cf. R.A.E.*, A **32** 301]. Replanting should not be carried out while any stage of these beetles is present in the stumps or major superficial roots, and in general an interval of three full forest years (1st October–30th September) should elapse in the milder parts of the country. Stumps that are less than 8 ins. in diameter, however, rapidly become unfavourable for breeding in the lowlands of southern and eastern England in coastal areas, on soils that enable them to dry out quickly, where the felled area is small, especially if it is surrounded by coniferous woodlands, and in areas where all the trees have been destroyed by fire; in these cirumstances replanting may be possible after two years. It may have to be postponed for at least four years at high elevations and on exposed sites, where the felled area is extensive, particularly if it is remote from other coniferous woods, or on moist, deep soil, and on partly burnt sites.

Provided that they are not near another area with stumps suitable for the beetles, areas can be safely replanted if they were felled more than four years before, or if examination of sample stumps by a method that is described shows that they are no longer susceptible. Such examinations should be made before the end of June in the summer preceding the date at which it is proposed to replant. Conditions are no longer favourable for *Hylastes* where the wood of the roots at a distance of 2–3 ft. from the stump has begun to decay and for *Hylobius* where the wood of the stump has begun to decay and there are no living stages in the main roots within 3 ft. of the stump.

The insects do not breed in the roots of small trees, less than 3 ins. in diameter at ground level, and burnt plantations of such trees can be replanted immediately, provided that no larger trees in the vicinity have recently been felled, killed or damaged by fire. Burnt areas containing stumps that do not exceed 8 ins. in diameter can generally be replanted within two years of burning. Trees that have been severely damaged by fire die slowly, but prompt felling causes their roots to become unfavourable almost as quickly as those of trees killed by fire.

Where a replanted area is likely to be infested by adults entering from elsewhere, it should be protected by billet-traps [**32** 303], placed at intervals of 22 yards along the edges nearest to the source of attack to trap them as they enter. Traps should not be placed within the replanted area unless a serious infestation develops there.

Cohen (M.) & Steer (W.). **The Control of Leatherjackets with D.D.T.**—*J. R. hort. Soc.* **71** pt. 5 pp. 130–133, 1 fig. London, 1946.

The results are given of experiments in England with DDT against larvae of *Tipula* spp. in turf. In November 1944, Guesapon E (solvent naphtha containing 5 per cent. DDT and an emulsifier) was diluted to 1 per cent. with water, to give a DDT content of 0·05 per cent., and applied with a watering can to a strip of turf four yards wide and about 30 yards long at the rate of 1 gal. per sq. yard, when the turf was moist and the weather mild. It caused Tipulid larvae and earthworms to come to the surface almost immediately and to show considerable muscular activity, though whether mortality of the larvae resulted was not then known. They averaged 180 per sq. yard. Early in May 1945, the same emulsion brought many larvae to the surface of test plots and a similar one without DDT brought up much smaller numbers. The distribution of the larvae in the plots was apparently uneven, but on ground that had been treated in the previous November, the DDT emulsion brought up none. To confirm the effect of the November treatment, a strip four yards wide and overlapping the original strip was treated on 14th May. Hardly any larvae appeared on the turf originally treated, and the few that did so were close to the edge. The line of demarcation between the areas that had and had not been treated six months earlier indicated that the first treatment had cleared the turf of larvae and kept it clear. Further small-scale treatments made elsewhere in November 1945 with the emulsion at the same strength and at half strength confirmed these results. Many larvae came to the surface, those kept under turf in a tin box became quiescent within a few days, showed no inclination to feed, and died in a week or a fortnight, and no further larvae appeared when the plots were subsequently treated. Stock and miscible emulsions containing DDT in other solvents all appeared to have the same effect when tested on a small scale. With all forms of emulsion the majority of the larvae came to the surface 30–90 seconds after treatment.

Dusting with 5 per cent. DDT in a china clay base in November 1945, whether or not it was followed by watering at the rate of 1 gal. per sq. yard, caused larvae to come to the surface within about two hours, and dead and dying larvae were readily observed on the surface ten days later. The application of a 1 per cent. emulsion to these plots brought up very few additional larvae, although the surrounding turf was heavily infested. Larvae did not come to the surface of a plot 20 sq. yards in area that was dusted at the rate of about 1½ oz. per sq. yard on 13th November when a cold wind was blowing, until 27th November, when the wind had abated and they appeared in considerable numbers.

It is concluded that DDT is effective in destroying Tipulid larvae whether it is watered into the turf in an emulsion or dusted over the surface. No ill effects to the grass were observed. November is probably the best time to carry out the treatment, as the larvae are then quite small and have not had time to do appreciable damage, but treatment in spring or early summer should give good results, as turf recovers quickly when the larvae are eliminated. Mild weather and moist soil conditions are preferable, and application when the ground is frozen would be useless.

FAES (H.), STAEHELIN (M.) & BOVEY (P.). **La défense des plantes cultivées.**—2nd edn., 8½×6 ins., 644 pp., 8 col. pls., 385 figs. Lausanne, Librairie Payot, 1947. Price *Fr.* 12.

The first part (pp. 7–91) of this book on pests of crops in Switzerland contains general information on animals and plants that are injurious to cultivated plants, indirect and direct methods of control, including notes on the various insecticides and fungicides and types of equipment for their application, and plant injuries caused by such factors as unfavourable growing conditions, nutritional deficiencies and insecticides. The second part (pp. 92–600) deals with specific pests and diseases and other factors adverse to the plants, which are classified as grape-vines, fruit trees and bushes, and field and market-garden crops. About half of this part is concerned with insect pests ; the information given on the individual species varies in scope with their importance, but generally includes a description of the insect and the damage it causes, an account of its bionomics, and the control measures. An appendix contains brief notes on the natural enemies of injurious insects and a table showing the French, German, Italian and scientific names of the various pests, disease organisms and parasitic plants.

BALACHOWSKY (A.). **Biologie et dégâts de la cicadelle verte** (*Tettigoniella viridis* **L.**) **en France.**—*Ann. Epiphyt.* (N.S.) **7** fasc. 1 pp. 65–83, 14 figs., 15 refs. Paris, 1941.

The results are given of investigations in 1936–39 on the biology of *Tettigella Tettigoniella*) *viridis*, L., in Deux-Sèvres, where the injury to trees by the slits it (makes for oviposition causes serious losses to fruit-growers [*cf. R.A.E.*, A **25** 208–209]. Similar damage was observed in other parts of France, particularly in the mountainous region of the Department of Pyrénées-Orientales, in the summer of 1938. The distribution of the Jassid and the food-plants of the nymphs are discussed, a list is given of the plants selected for oviposition, and the damage caused by the oviposition punctures to trees of different species and different ages is described. Although *T. viridis* is abundant in marshy ground and near ponds and running water throughout France, it is injurious only in certain localities in which an abundance of tall, thick vegetation on marshy ground favours the growth of the nymphs and a lack in the pastures of graminaceous plants with a hard haulm (*Phragmites* or *Juncus*) suitable for oviposition results in egg-laying in the trees.

The winter is passed in the egg stage. In Deux-Sèvres, hatching usually begins in April and continues for some weeks. Recent observations have shown that the nymphs mature more quickly than had been supposed [**25** 209], only adults being present after mid-June. The nymphs migrate from the trees on which they hatch to fields of long grass, where they feed in moist, sheltered positions at the base of the plants, and the young adults migrate from these to sunny fields of short grass from June onwards. Mating occurs from about the middle of September, after which the females begin to leave the fields for the trees on which they oviposit. Adults do not survive the winter, males disappearing about the end of October and females about the middle of December.

Investigations on methods of protecting fruit trees during the oviposition period are described. Keeping adhesive bands round the trunks of pear and apple trees from the end of August until January resulted in few punctures above them when they were 16 or 24 ins. above the ground, and practically none above but many below when they were 60 ins. above the ground, and the application of one band 40 ins. from the ground, preferably with another 10 ins. higher, is recommended. Bands 4 and 6 ins. above ground on currant bushes were ineffective. Attempts to control the adults by scattering cubé or pyrethrum dust round the base of the trees for a distance of 8 ft. were unsuccessful, but spraying the soil around the base of the trees with a 20 per cent. emulsion of heavy coal-tar oil for a distance of 13–17 ft. repelled the Jassids for a long period, and naphthalene scattered similarly at the beginning of September, and in October and November, completely prevented attacks until October, when a few punctures were observed. Coal-tar creosote and β-naphthol used in the same way were ineffective. Growing varieties of trees with tall trunks and grafting as high as possible are additional measures of protection.

LEPESME (P.). **Contribution à l'étude de** *Volumnus obscurus* **Popp. (Hemiptera Capsidae), agent de la "coulure" des fleurs de caféier en Afrique Centrale.**—*Ann. Epiphyt.* (N.S.) **8** fasc. 1 pp. 47–59, 9 figs., 3 refs. Paris, 1942.

Serious loss was caused in a coffee plantation at Libonga, in the Gaboon, in 1937 and 1938 through the abortion of a high percentage of the flower buds. This was found to be caused by the feeding of the Mirid, *Volumnus obscurus*, Popp., which is known to attack coffee in other parts of Africa but is not usually a serious pest [*cf. R.A.E.*, A **22** 197; **23** 379; **28** 95; **31** 521], and which was found on a great variety of wild plants growing in swampy places in other parts of French Equatorial Africa and the Cameroons. The author reviews its systematic position and describes the nymphs and adults; both suck the sap of plants, attacking flowers, buds, young leaves, or any tender and juicy part. They are active, and tend to avoid strong light; the adults are not capable of sustained flight. There were thought to be several overlapping generations a year at Libonga; adults in captivity did not survive for more than four days, whereas nymphs were still living after more than ten days.

The heavy infestation at Libonga was attributed to the favourable climate and to peculiarities of the site. The clay soil was difficult to drain and wide swampy pools formed along the streams in many places, giving rise to a rich natural flora on which *V. obscurus* was abundant. During the dry season, which lasts from mid-May to late September, these pools dry up, the wild vegetation dies, and the only available source of food is the coffee. The main flowering of the coffee occurs at the end of August and in September, but leaf buds and young shoots are present in early June and flower buds in mid-July, and the infestation increases in severity until the coming of the rains. There is also usually a short dry season in January–February, but it is not very marked and migration to coffee is slight.

Suggested control measures, the application of which was begun in 1939, comprised draining the swamps and destroying their wild vegetation, and dusting the coffee trees with a mixture of pyrethrum powder and wood ash (1 : 4–6). It is suggested that the dust should be applied whenever the population on sample trees 2–3 weeks before flowering exceeds three on arabica coffee or five on robusta or excelsa. The trees should be rigorously pruned a month before flowering.

RUSSO (G.). **Contributo alla conoscenza degli insetti dannosi al cotone nell' Africa Orientale Italiana. I. Lepidotteri.** [A Contribution to the Knowledge of Insects harmful to Cotton in Italian East Africa. I. Lepidoptera.]—*Boll. R. Lab. Ent. agr. Portici* **3** pp. 105–220, 2 pls., 54 figs., 9 pp. refs. Portici, 1940.

The author studied the pests of cotton in Somalia in 1930 [*cf. R.A.E.*, A **23** 102, etc.] and in this paper gives the results of his observations on Lepidoptera. The species dealt with comprise *Platyedra gossypiella*, Saund., *Pyroderces coriacella*, Sn., and *Argyroploce leucotreta*, Meyr., which chiefly attack the bolls, *Earias biplaga*, Wlk., *E. insulana*, Boisd., *Diparopsis castanea*, Hmps., and *Heliothis armigera*, Hb., which damage bolls, flowers and shoots, *Acrocercops bifasciata*, Wesm., *Sylepta derogata*, F., *Diacrisia* (*Spilosoma*) *investigatorum*, Karsch, *Prodenia litura*, F., and *Cosmophila flava*, F., which feed on the leaves, *Mometa zemiodes*, Durrant, which attacks the seeds in the field and continues to infest them in store, *Corcyra cephalonica*, Staint., which is a pest of the stored seed only, and *Euproctis fasciata*, Wlk., which was taken in rearing cages containing branches and leaves of cotton and had not previously been recorded from Somalia. Descriptions are given of their various stages, together with accounts (for all except the last) of their world distribution, bionomics and alternative food-plants, and suggestions for their control.

The one dealt with in greatest detail is *Platyedra gossypiella* [*cf.* **19** 504 ; **20** 339], all stages of which were present throughout the year and which destroys 20–30 per cent. of the crops in Somalia. The female lays about 250 eggs, which hatch in 3–4 days. The larvae complete their development in 15–20 days and pupate below the surface of the ground or occasionally in fallen bolls. The adults emerge after 9–12 days, and survived in captivity for 10–20 days. The larvae were parasitised by *Brachymeria inornata*, Masi [*cf.* next abstract], *Eurytoma verbena*, Ferrière, *Bracon* (*Microbracon*) *kirkpatricki*, Wlkn., which was the most important, and a species of *Chelonus* (*Chelonella*) identified by Ferrière as *C.* (*C.*) *versatilis*, Wlkn. It is stated in a footnote that Masi could find no difference of specific importance between examples of this species from Somalia and those previously identified by Wilkinson as *C.* (*C.*) *curvimaculatus*, Cam. [**19** 505]. The mite, *Pediculoides ventricosus*, Newp., and the ant, *Tetramorium sericeiventre*, Emery, were predacious on the larvae of *Platyedra*, while an Anthocorid of the genus *Orius* (*Triphleps*) attacked the eggs. Control measures are discussed from the literature ; those considered most applicable in Somalia include the prompt collection of infested bolls and the exposure to direct sunlight of the raw cotton, spread out in a layer so that the larvae are either killed by the heat (exposure for 5–10 minutes to 50–60°C. [122–140°F.] is sufficient) or destroyed as they leave the cotton to seek shelter. Storehouses should be screened to prevent the escape of adults that emerge in them, and pupae in the soil can be killed by ploughing. A regular planting season should be observed throughout the country, alternative food-plants destroyed, and all cotton eliminated after the third crop, which is normally gathered when the infestation is at its height and is often uneconomic. Light traps set up in cotton fields did not attract the adults.

Larvae of *Earias biplaga* and *E. insulana* were occasionally parasitised by an unidentified Braconid of the genus *Rogas*, and those of *Heliothis armigera* by *Apanteles* sp. and two Tachinids. Adults of *Antrocephalus aethiopicus*, Masi, and *A. crassipes*, Masi [*cf.* next abstract] were taken in a store containing cottonseed, and these Chalcids may therefore have been parasitic on *Corcyra cephalonica*.

MASI (L.). **Descrizioni di Calcididi raccolti in Somalia dal Prof. G. Russo con note sulle specie congeneri.** [Descriptions of Chalcidoids collected in Somalia by Prof. G. Russo, with Notes on congeneric Species.]—*Boll. R. Lab. Ent. agr. Portici* **3** pp. 247-324, 19 figs, 34 refs. Portici, 1940.

In the course of the introduction to this paper, the author states that a comparative examination has shown no specific characters differentiating *Dirhinus auratus*, Ashm., or *D. frequens*, Masi, from *D. excavatus*, Dalm.

In the main part of the paper he describes, from material collected in 1930 by Russo in Somalia, the adults of 22 species and one variety of Chalcidoids in 12 genera ; 18 species (for one of which a new genus is erected) and the variety are new. The new species include the Chalcids, *Brachymeria* (*Neobrachymeria*) *inornata*, reared from fruits of *Hibiscus dongolensis* infested by larvae of *Platyedra gossypiella*, Saund., and *Antrocephalus crassipes*, adults of which were taken in a cotton-seed store [*cf.* preceding abstract], and the Eulophid, *Dimmockia somalica*, which is thought to be a parasite of *Acrocercops bifasciata*, Wlsm., on cotton. Keys are included to the species of *Podagrion*, *Spalangia*, *Dimmockia*, *Pleurotropis*, *Tetrastichus* and *Aprostocetus* of the Ethiopian Region, and to certain groups of species of other genera.

GHOSH (C. C.). **Insect Pests of Burma.**—9½×7½ ins., [1] ii+216+xv pp., 87 pls. (76 col.), 106 figs. Rangoon, Supt. Govt. Print. & Stat., 1940. Price *Rs.* 7-8-0 or 11*s.* 3*d.*

The first part of this book on insect pests of crops in Burma comprises a general account of the life-history, habits and classification of insects and of natural and artificial means of control, with formulae for the preparation of insecticides and instructions for their use. In the second part, more detailed information is given on the life-history and control of pests, mostly insects, that are common on field and garden crops, ornamental plants, and fruit trees, in stored products and other commodities, and in buildings, and on the damage caused by them. Most of the insects are illustrated in colour and their local names are given. In general, the preventive and control measures recommended are simple and practicable under local conditions.

FULTON (R. A.) & NELSON (H. D.). **Use of the Blower Applicator in Fumigation.**—*Calif. Citrogr.* **31** no. 5 pp. 154, 166–167, 5 figs., 2 refs. Los Angeles, Calif., 1946.

The authors briefly describe and illustrate an apparatus for the fumigation of *Citrus* against *Aonidiella aurantii*, Mask., in California, by means of which liquid hydrocyanic acid is atomised into a stream of air released inside the fumigation tent [*cf. R.A.E.*, A **30** 433]. A wedge separates branches and leaves immediately in front of the air-stream [*cf.* **33** 346] and the blower fan is allowed to run for 15 seconds after the fumigant is released. The efficiency of this blower applicator was compared with that of a vaporiser in tests carried out in 14 nights, in which scales of a relatively resistant strain on lemons were placed in different positions in the tents after having been stupefied with a dose of 0·05 mg. HCN per litre to avoid erratic results due to drift gas. Higher mortalities were obtained with the blower on all nights but one, on which the kills were practically equal. The average mortalities of mature scales were 68·2 per cent. for the blower and 60·9 per cent. for the vaporiser. No difference was found in retention of gas under tents of drill or duck.

The blower was also used in tests to compare duck tents with tents of fabric made gastight or semi-gastight by treatments with plastic material. The semi-gastight tests were used to retard the loss of gas but allow sufficient leakage to lower the concentration somewhat and reduce the danger to operators of the residual gas. A graph is given showing the changes in concentration of HCN during the fumigation period of 45 minutes in duck, gastight and semi-gastight tents receiving dosages of 20, 7 and 14 ml. per litre, respectively; the three curves have the same average concentration, which is the concentration of importance when protective stupefaction is a factor [**32** 272]. As the standard chart for fumigation of *Citrus* includes correction for leakage for trees of different sizes, it is not suitable for gastight tents, and a new schedule, which is compared with it on a graph, was calculated on the basis of the actual volume. It is estimated that the saving in HCN in gastight tents as compared with duck tents would be about two-thirds for small trees and about half for large ones.

In 11 fumigations made between 1st February and 24th August 1944 with dosages of 7 and 20 ml. per litre for gastight and duck tents, respectively, and exposures of 45 minutes, the average concentrations of HCN were 1·07 and 1·01 mg. per litre, respectively, and the average kills of stupefied Coccids on lemons were 74·5 and 70 per cent. Kills were usually lower near the outside of the tree than further in under duck tents, but uniform under gastight tents. During September and October, there was a little more pitting of young fruits due to fumigation on trees that had been treated under gastight tents than on the others.

THORNE (F. T.). **Temperature Relations to Red Scale Increase.**—*Calif. Citrogr.* **31** no. 5 p. 190. Los Angeles, Calif., 1946.

Field observations showed a sharp increase in infestation by the California red scale [*Aonidiella aurantii*, Mask.] in *Citrus* areas of California in the autumn of 1945, and this is believed to be correlated with unusually high temperatures, the mean temperatures for August, September and October in one locality being 75·3, 73·4 and 67·5°F., as compared with 73·6, 70·7 and 64·9° during the 30 years from 1901 to 1930. The average maximum and minimum temperatures for each month from January to November for 25 years (1906–1930) and the mean temperatures for these months for the 30-year period are compared in a table with the corresponding temperatures for 1945.

PALMITER (D. H.). **Ground Treatments as an Aid in Apple Scab Control.**—*Bull. N. Y. agric. Exp. Sta.* no. 714, 27 pp., 6 figs., 4 refs. Geneva, N.Y., 1946.

In the course of this account of the results obtained in New York on the control of apple scab (*Venturia inaequalis*) by the application of sprays to the ground in early spring to kill the spores of the fungus that have overwintered on fallen leaves, it is pointed out that sodium dinitro-ortho-cresylate, which was effective against the fungus at concentrations below 1 per cent., is a good ovicide and has been recommended for the control of such insects as Aphids, bud moth [*Spilonota ocellana*, D. & S.], tent caterpillar [*Malacosoma americana*, F.], and oyster shell scale [*Lepidosaphes ulmi*, L.] on dormant apple trees. Where any of these insects are troublesome, the trees and the ground may be sprayed at the same time with a concentration depending on the amount recommended against the particular insects present, but not less than the equivalent of 0·5 per cent. Elgetol (which is stated to contain 22 per cent. sodium dinitro-o-cresylate, 12 per cent. penetrant and 56 per cent. water) if scab control is the primary concern.

MUNRO (J. A.) & HOYMAN (W. G.). **Evaluation of various Spray and Dust Materials in the Control of Insects and of the Fungus causing Early Blight of Potatoes.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **8** no. 3 pp. 23–30. Fargo, N. Dak., 1946.

The results are given of tests in North Dakota in 1945 of recently developed proprietary insecticides and fungicides in combined treatments for the control of insects that attack potato and the prevention of infection by *Alternaria solani*, which causes early blight. Treatments were applied in field plots four times at intervals of 10–14 days between 16th July and 23rd August at Grand Forks and five times at approximately the same intervals between 17th July and 28th August at Park River, the rate of application increasing from about 75 to 100 U.S. gals. spray and from 15–20 to 30–35 lb. dust per acre as the plants increased in size. Collections made with a net between mid-July and late August showed that *Macrosteles divisus*, Uhl., *Empoasca fabae*, Harr., *Epitrix cucumeris*, Harr., and *Leptinotarsa decemlineata*, Say, were the most important insects present on potato, though none of them became more than moderately abundant at either locality ; the first was the most difficult to control and the others progressively less so, but the numbers of all four were reduced by all treatments. At Grand Forks, there was no significant difference in insect control between three dusts containing DDT with Dithane [disodium ethylene bis-dithiocarbamate], Fermate [ferric dimethyl dithiocarbamate] or Zerlate [zinc dimethyl dithiocarbamate] and the corresponding sprays, but at Park River, seven dusts containing DDT with Fermate, Zerlate or a copper fungicide gave better control than the corresponding spray, possibly because of inadequate coverage of the foliage during the second spray application. DDT proved more effective in combination with Zerlate, copper or copper and sulphur than with other fungicides. DDD [2,2-bis(p-chlorphenyl)-1,1-dichlorethane] was less effective than DDT, and arsenicals still less so. Aphids were common on plants treated with arsenicals, but the other insecticides apparently controlled them. Species of *Lygus* were present to a limited extent on most of the plots and appeared to be little affected by the insecticides. The effect of the various treatments on predacious insects was not clearly demonstrated ; their numbers appeared to be correlated with the presence of Aphids, on which they fed, more than anything else.

BRANDES (G. A.) & SWISHER (E. M.). **Spray and Dust Treatments of Potato Demonstration Plots, 1945.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **8** no. 3 pp. 33–39. Fargo, N. Dak., 1946.

Treatments consisting of combinations of insecticides and fungicides, applied to demonstration plots of potato at 15 points throughout the potato-growing area of north-eastern North Dakota during the summer of 1945, gave similar results against *Macrosteles divisus*, Uhl., *Empoasca fabae*, Harr., *Epitrix cucumeris*, Harr., and *Leptinotarsa decemlineata*, Say, to those obtained in small-scale tests [*cf.* preceding abstract]. The combinations containing DDT gave the best control, and good control of *E. cucumeris* with it generally resulted in lower incidence of early blight (*Alternaria solani*). Yield data showed only slightly significant differences in most of the dusted plots, but a mixture of DDT, a pyrethrum dust (pyrocide) and a copper fungicide, and one of a dinitro dust and copper gave slightly higher yields than DDT and copper, and this than arsenicals and copper. Variations in yield were small and of little significance in plots sprayed with DDT and Dithane, Fermate or copper or with Dithane and arsenicals, but treatment with DDT and Dithane resulted in higher yields than treatment with copper and arsenicals or than one application of arsenical dust with no fungicide.

SIMPSON (G. W.), SHANDS (W. A.) & WYMAN (O. L.). **Weeds and the Aphid-Leafroll Problem in Potatoes.**—*Ext. Bull. Maine Coll. Agric.* no. 333, 20 pp., 7 figs. Orono, Me., 1945.

The destruction of weeds is of considerable importance in the control of the Aphids that transmit leaf-roll [*Corium solani* of Holmes] to potato in Maine [*cf. R.A.E.*, A **34** 226]. *Myzus persicae*, Sulz., which is the most important field vector, overwinters on *Prunus nigra*, *Aphis rhamni*, Boy. (*abbreviata*, Patch) on *Rhamnus alnifolia*, *Macrosiphum solanifolii*, Ashm., on wild and cultivated roses, and *M. solani*, Kalt. (*Myzus convulvuli*, Kalt.), which is uncommon in potato fields, on *Digitalis purpurea* [*cf.* **29** 188] ; all migrate to certain weeds in spring and from these to potato in summer, though potato may be infested directly if it is available so early. Of the weeds that serve as summer food-plants, *Brassica campestris* is important for *A. rhamni*, *Macrosiphum solanifolii* and, particularly, *Myzus persicae*, *Raphanus raphanistrum* chiefly for *M. persicae* and *A. rhamni*, *Galeopsis tetrahit* and *Polygonum lapathifolium* for *A. rhamni* and *Macrosiphum solanifolii*, and *Chenopodium album* for *M. solanifolii* and *Myzus persicae*. *Chrysanthemum leucanthemum* var. *pinnatifidum* is favoured by *A. rhamni* in years in which it is producing buds when the Aphid is migrating, and *Rumex acetosella* is also infested by this Aphid in some seasons. The importance of these weeds as food-plants for Aphids depends on the position in which they grow, their size or age, soil moisture and air temperature. Weeds growing anywhere may serve as a source of early-season winged Aphids, but those growing in wasteland, among crimson clover or in places where there is no competition from tall-growing crops, such as oats, are the most important in producing large numbers.

The infestation of potato can be reduced by controlling weeds growing in waste land, by spraying or dusting or by harrowing, in potato fields themselves by early and frequent cultivation or more drastic measures if the weeds are numerous, and in fields of oats or other tall-growing crops by spraying or dusting early [*cf.* **34** 226, 227]. Control in late-starting low-growing crops such as crimson clover [*cf.* **34** 227] is difficult but is assisted by sowing rye grass or canning peas with the clover. Crimson clover can be replaced as a green manure crop by Japanese millet, which grows rapidly and smothers weeds.

Possible reasons for the increase in importance of Aphid infestation during the last few years are discussed.

BROMLEY (S. W.). **Wheel-bug vs. Japanese Beetle.**—*Ent. News* **57** no. 1 p. 21. Lancaster, Pa., 1946.

Following Moul's record of the wheel-bug [*Arilus cristatus*, L.] preying on adults of the Japanese beetle [*Popillia japonica*, Newm.] in Pennsylvania [*R.A.E.*, A **34** 145], the author quotes from a letter in which H. S. Porter describes a similar observation at Somerville, New Jersey. Each tree had hundreds of dead beetles beneath it, and the bugs were present in great numbers. No spraying had been done.

Insects.—*Bull. Idaho agric. Exp. Sta.* no. 264 (52nd Rep. 1944–45) pp. 33–35. Moscow, Idaho, 1945.

W. E. Shull reports that potato tubers from the 1943 crop in Idaho had slight " worm track " damage. Investigations in the field in 1944 showed that the injury was caused by flea-beetles, of which *Epitrix subcrinita*, Lec., was the most numerous and that neither *E. cucumeris*, Harr., nor *E. tuberis*, Gentner, was present [*cf. R.A.E.*, A **33** 220].

T. A. Brindley, R. Schopp & W. E. Shull found that a dust containing 5 per cent. DDT applied at 30 lb. per acre was as effective against the pea Bruchid [*Bruchus pisorum*, L.] on peas as one containing 0·75 per cent. rotenone at 20 lb. per acre. Studies of the adults hibernating in cages showed that 66·4 per cent. survived the winter of 1943–44, the second highest figure recorded over six years. The percentage infestation throughout the State averaged 2·51 for graded crops, as compared with 2·17 in 1943.

F. H. Shirck, J. R. Douglass & W. E. Shull state that in field tests against the onion thrips [*Thrips tabaci*, Lind.] on onion in the spring of 1944, sprays of 2 lb. tartar emetic or 1 U.S. quart nicotine sulphate per 100 U.S. gals. water, sweetened with honey or maize syrup, respectively, resulted in similar yields. Sprays of 8 oz. DN-111 (20 per cent. of a dicyclohexylamine salt of 2,4-dinitro-6-cyclohexylphenol) or 4 lb. of a mixture of 10 per cent. DDT in pyrophyllite per 100 U.S. gals., and a dust consisting of Code 2 (20 per cent. azobenzene in talc) at approximately 40 lb. per acre, were all ineffective. A dust containing 5 per cent. DDT in pyrophyllite at approximately 31 lb. per acre gave indications of controlling the thrips and of increasing the yield, but none of the treatments tested gave significant increases in yield. Injury was very light, since conditions in June were unfavourable for reproduction and development of the thrips.

Sleesman (J. P.). **DDT for the Control of Onion Thrips.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **31** no. 239 pp. 39–40. Wooster, Ohio, 1946.

The value of two sprays and a dust containing DDT against the onion thrips [*Thrips tabaci*, Lind.] was investigated in experimental plots of onions in Ohio in 1945, when infestation was severe and untreated plants were killed early in the season. One spray contained 12 oz. DDT as an emulsified oil solution and the other 1 lb. DDT as a wettable powder per 100 U.S. gals. water, and both were applied at a pressure of 300 lb. and a rate of 200 U.S. gals. per acre. The dust contained 3 per cent. DDT and was applied at 65 lb. per acre. All three treatments were applied four times at weekly intervals beginning on 30th July and gave almost complete control ; populations were reduced after each application and remained low for at least seven days. By 20th August, the treated plants were twice as tall as the controls and the subsequent yields were significantly greater. The increase in yield was practically the same in all the treated plots, though the sprays gave somewhat better control of the thrips than the dust.

Walton (R. R.). **The Southwestern Corn Borer.**—*Mimeogr. Circ. Okla. agric. Exp. Sta.* no. M-153, 4 pp. multigraph. Stillwater, Okla., 1945.

The south-western corn-borer [*Diatraea grandiosella*, Dyar] has recently become an important pest of maize in Oklahoma [*cf.* *R.A.E.*, A **34** 180]. It was present over the western part of the State roughly as far as a line from Osage County to Marshall County in 1934, and was thought to have spread further eastwards in 1945. The nature of the injury to maize is described [**32** 348]. In Oklahoma, the overwintered larvae pupate in early or mid-May and the adults emerge between the second half of May and mid-June or later. Eggs are laid in clusters on the maize plants soon after emergence. The first generation larvae hatch from early June onwards, and larvae of a second generation hatch in late July and are especially injurious to late plantings. There is a partial third generation, but most second-generation larvae enter hibernation in the root tips in August and September.

Tests carried out over three years in various parts of Oklahoma showed that maize sown in late March and April suffered less injury and gave higher yields than that sown later ; maize planted after 15th May was severely damaged by second-generation larvae. Uprooting the stubble not later than January or ploughing it under to a depth of at least 4 ins. before May and leaving it covered until late May or early June afford some control of the overwintering larvae. Suitable implements are suggested, and it is emphasised that these treatments are ineffective unless generally applied. Rotation of crops and the substitution, where possible, of sorghum for maize are recommended ; sorghum is lightly infested but the damage to it is seldom important.

SMITH (R. W.). **Hessian Fly in the Spring Wheat of southwestern North Dakota.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **8** no. 4 pp. 3–6, 2 refs. Fargo, N. Dak., 1946.

Following a succession of cool seasons with good rainfall, unusually severe and widespread damage to spring wheat by the Hessian fly [*Mayetiola destructor*, Say] was reported in June 1944 in south-western North Dakota, where it had not been abundant since 1924. Examination of several wheat fields in the vicinity of the Dickinson Experiment Station showed every field to be infested to some extent with larvae or pupae, which were found at or near the surface of the ground between the leaf sheath and stem ; varietal field plots of spring wheat at this station were also affected. To determine whether any particular varieties were resistant, counts were made in June 1944 and June 1945 of the numbers of insects present on plants taken at random from plots of each variety. The results, which were confirmed by a test carried out by J. A. Munro in 1945 and by the observations of farmers, showed that the Mida variety was less infested and definitely more resistant than other standard varieties of spring wheat commonly grown in the district. A new local variety, N. No. 1924, produced by crossing Mida with N. No. 1552, is thought to have the resistance of Mida, since it showed fewer flies in 1945, the first year in which it was grown in the field test. The correlation coefficients obtained between infestations in 1944 and 1945, and between infestations and yields in 1944 and 1945, indicated definite resistance in certain varieties and higher yields due partly to it. The author considers that the resistance of the variety Mida may originate from the same source as that of Marquillo [*cf. R.A.E.*, A **29** 366] and is likely to be transferred to the new varieties resulting from crossings with Mida.

At the beginning of the winter of 1945–46, spring wheat stubble contained numerous pupae that had apparently been there since the summer ; most of them were living, despite the dry autumn, and it was thought possible that if favourable conditions prevailed in 1946, serious losses might again be caused.

FISHER (W. S.). **A Change of Name in Cerambycidae.**—*Proc. ent. Soc. Wash.* **47** no. 8 p. 251. Washington, D.C., 1945.

The author points out that *Cyllene*, Newm., is preoccupied in Mollusca, but that *Megacyllene* is an available name for it.

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BRINDLEY (T. A.), CHAMBERLIN (J. C.), HINMAN (F. G.) & GRAY (K. W.). **The Pea Weevil** [*Bruchus pisorum*, L., in U.S.A.] **and Methods for its Control.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1971, 24 pp., 14 figs. Washington, D.C., 1946. [*Cf. R.A.E.*, A **26** 653 ; **27** 325 ; **30** 36.]

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VAPPULA (N. A.). **Finnish Entomological Literature published in 1945 including** [titles of papers on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **12** appx. 17 pp. Helsinki, 1946. [*Cf. R.A.E.*, A **33** 406.]

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